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EXTRACT

REPORT OF THE MISSISSIPPI RIVER COMMISSION



WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

[EXTRACT FROM THE ANNUAL REPORT OF THE CHIEF OF ENGINEERS
TO THE SECRETARY OF WAR.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, October 8, 1917.

* * * * *

MISSISSIPPI RIVER COMMISSION.

Improvement of Mississippi River in charge of the Mississippi River Commission.

Commission headquarters.—St. Louis, Mo.

Commissioners.—The commissioners during the fiscal year were Col. C. McD. Townsend, Corps of Engineers, United States Army, president until June 8, 1917; Col. J. G. Warren, Corps of Engineers, United States Army, acting president from June 9, 1917; J. A. Ockerson, civil engineer; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Charles H. West, civil engineer; Col. Lansing H. Beach, Corps of Engineers, United States Army; and Edward A. Glenn.

Secretary and district officers.—The following officers of the Corps of Engineers, United States Army, were on duty under the commission during the year: Secretary, Maj. Clarke S. Smith; officers in charge of first and second districts, Maj. E. M. Markham, Maj. Michael J. McDonough, and Lieut. Col. G. P. Howell; officer in charge of third district, Maj. John R. Slattery; officers in charge of fourth district, Maj. W. G. Caples, Maj. Richard C. Moore, Capt. Beverly C. Dunn, and Lieut. Col. G. McC. Derby.

Location and description.—The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvements of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya Rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters and with gauging the river and its tributaries. By act of Congress approved March 4, 1913, an appropriation for levees from Cape Girardeau, Mo., to Rock Island, Ill., was made for expenditure under the commission. Acts of Congress approved July 27, 1916, and March 1, 1917, provided for the continuation of levee work from Cape Girardeau, Mo., to Rock Island, Ill., and extended the jurisdiction of the Commission to include work on the Ohio River from its mouth to the mouth of the Cache River, and on the Arkansas River from its mouth to its intersection with the division line between Lincoln and Jefferson Counties.

Original condition.—The portion of the river under its jurisdiction receives the drainage of about 1,240,050 square miles of country between the Rocky and Appalachian Mountain Ranges. It is subject to great variations in the amount of water flowing at different

seasons, the difference between extreme high and low water at Cairo being about 55 feet and the volume of water varying from about 85,000 to 2,000,000 second-feet. In its original condition, sand bars formed across the channel which during low water sometimes limited the navigable depths to $4\frac{1}{2}$ feet.

Previous projects.—The original project contained in the report of the Mississippi River Commission, dated February 17, 1880, contemplated the permanent fixing and improvement of the channel to a depth of at least 10 feet at extreme low water by the contraction of the low-water width to about 3,000 feet, the protection of the banks against caving, and the control of the flood water by means of levees.

Present project.—The present project is to maintain a channel not less than 9 feet deep and not less than 250 feet wide from the mouth of the Ohio River to the Head of Passes near the Gulf of Mexico by open channel work and by dredging; to confine the river to a permanent position as far as practicable by bank revetment and the construction of levees below Cape Girardeau, Mo., to regulate the river and to prevent overflow; and to build such levees between Rock Island, Ill., and Cape Girardeau, Mo., in aid of navigation as may be found necessary or desirable. In executing this work the commission is authorized to make such surveys, examinations, and investigations of the Mississippi River and its tributaries as may be deemed necessary. Acts of Congress approved June 28, 1879; June 3, 1896; September 19, 1890; March 3, 1905; June 4, 1906; March 4, 1913; July 27, 1916; March 1, 1917.

Operations and results during the fiscal year.—Maps of the resurvey of the river from Cairo, Ill., to the mouth of Red River, La., have been completed. Gages were maintained and discharge observations made on the Mississippi River and tributaries. Below Cairo 34,644 linear feet of bank was revetted, and about 3,730,000 square feet of mattress was built and placed for repairs to old work. A total of 16,328,074 cubic yards was placed in the levees between Head of Passes, La., and Cape Girardeau, Mo., and about 99,587 cubic yards were placed in levees between Cape Girardeau and Rock Island, Ill. Dredging was done at all obstructing bars below Cairo during the low-water season, and project depth of 9 feet was maintained. Dredging was also done for the improvement of Memphis Harbor. The plant pertaining to the above works has been maintained in good condition, and necessary additions made thereto.

Condition at the end of fiscal year.—The general survey of the Mississippi River from Head of Passes, La., to its headwaters at Lake Itasca, Minn., has been completed, and maps of the river published. The resurvey from Cairo, Ill., to the mouth of Red River, La., has been completed and maps therefrom prepared for publication. Various discharge, gauge, and other observations have been made on the Mississippi River and tributaries and the Gulf of Mexico. Works for improvement of the channel have been executed at various places below Cairo. Revetment work below Cairo is now in place and in good condition on about 92 miles of river bank. There are 1,509 miles of effective levees, containing about 313,656,415 cubic yards, between Head of Passes, La., and Cape Girardeau, Mo., and about 452 miles of river front protected by levees more or less effective, between Cape Girardeau, Mo., and Rock Island, Ill. The

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levees below Cape Girardeau protect about 26,569 square miles of land, and those above Cape Girardeau protect about 676 square miles. About 69 per cent of the total yardage required to complete the levees below Cape Girardeau is now in place. Dredging has been done annually since 1895 below Cairo, where necessary to maintain a navigable channel 9 feet in depth. In the Mississippi River there is now, with rare exceptions, a good navigable channel at all stages, with a depth of 9 feet or more over a width of at least 250 feet for a distance of 833 miles below Cairo, and a depth of not less than 30 feet over a width of several hundred feet for the remaining 240 miles to the Gulf of Mexico. The necessary plant required for surveys, dredging, and bank-protection work has been constructed and maintained.

Local cooperation.—It has been almost entirely in the construction of levees and revetments that the local authorities have contributed toward the improvement of the river. The organized levee boards have constructed a large portion of the existing levee line, but it is only in recent years that local interests have contributed toward revetment construction, and these contributions have been a small proportion of the cost of these works.

Effect of improvement.—In a general way it may be stated that the improvement is providing a safe and easy channel for navigation, and is now in condition to prevent the destructive effects of floods in all except the most extreme high waters.

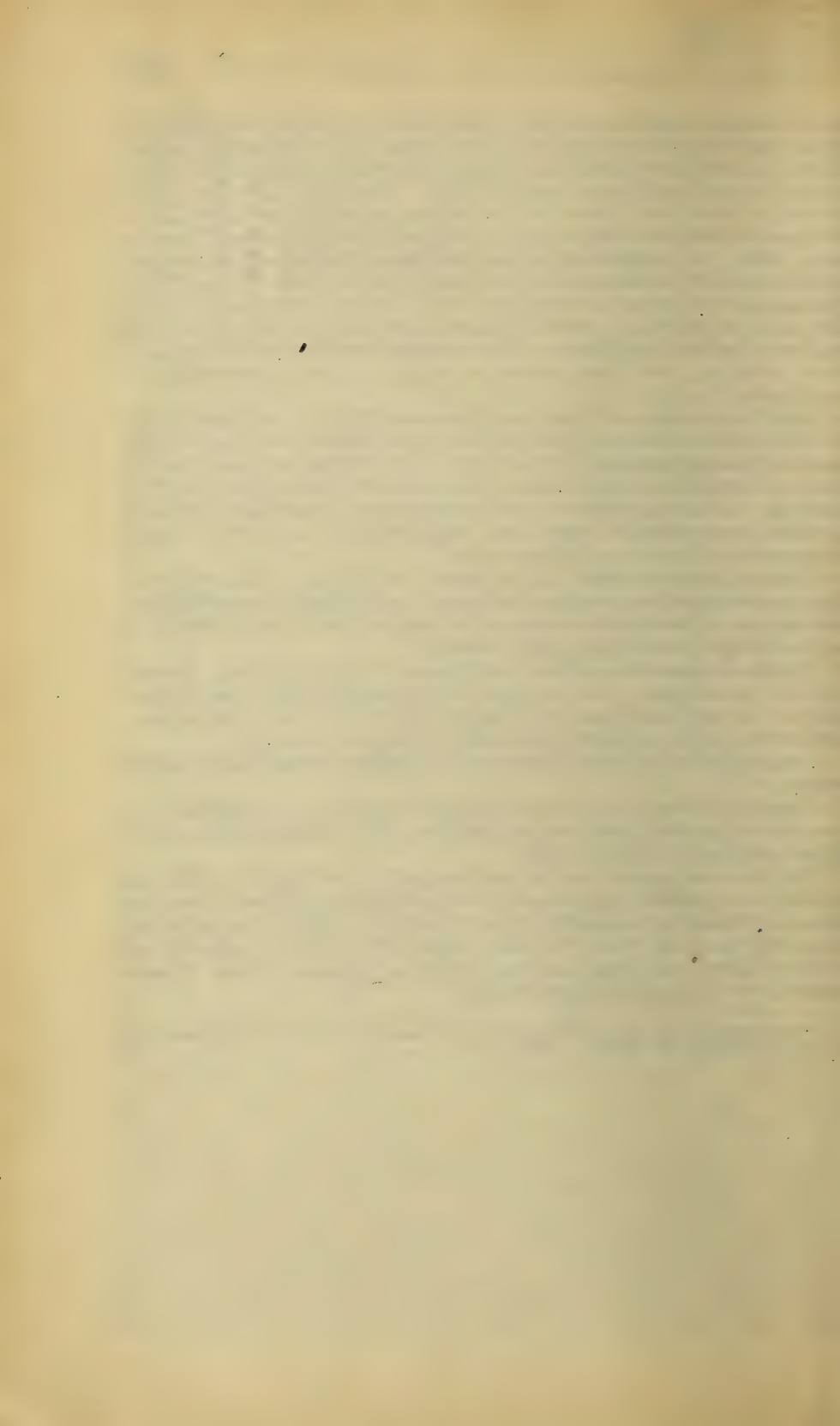
Proposed operations.—The maintenance of the project channel depths, the existing river location and present harbors, the prevention of caving banks, and the completion of the levee systems constitute the principal results for which funds are necessary.

Commercial statistics.—These are appended to the commission's report.

Estimate of funds required.—Amount that can be profitably expended in the fiscal year ending June 30, 1919, exclusive of the balance unexpended July 1, 1918:

For work authorized by the flood-control act of March 1, 1917, including the general improvement of the Mississippi River from the Head of Passes to the mouth of the Ohio River, the building of levees from the Head of Passes to Rock Island, Ill., surveys, and salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission, \$10,000,000.¹

¹ This estimate is for appropriation in the next sundry civil act for work authorized by the flood-control act of Mar. 1, 1917.



ANNUAL REPORT OF THE MISSISSIPPI RIVER COMMISSION FOR THE
FISCAL YEAR ENDING JUNE 30, 1917.

OFFICE MISSISSIPPI RIVER COMMISSION,
St. Louis, Mo., July 12, 1917.

From: The Mississippi River Commission.
To: The Chief of Engineers, United States Army.
Subject: Annual Report for 1917.

The act of June 28, 1879, by which the commission was created, defines its duties in part, as follows:

To direct and complete such surveys of said river, between the Head of the Passes near its mouth to its headwaters, as may now be in progress, and to make such additional surveys, examinations, and investigations, topographical, hydrographical, and hydrometrical, of said river and its tributaries as may be deemed necessary by said commission to carry out the objects of this act. * * * To take into consideration and mature such plan or plans and estimates as will correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River; improve and give safety and ease to the navigation thereof; prevent destructive floods; promote and facilitate commerce, trade, and the Postal Service; * * *.

Under the authority of this and subsequent acts relating to the subject, surveys and observations have been carried on and works of improvement under the authority and direction of laws making appropriations for that purpose have been undertaken and executed. The original project contained in the report of the Mississippi River Commission dated February 17, 1880, contemplated the permanent fixing and improvement of the channel to a depth of at least 10 feet at extreme low water by the contraction of the low-water width to about 3,000 feet, the protection of the banks against caving, and the control of the flood waters by means of levees. This report was the one upon which Congress made its first appropriation for the improvement of the Mississippi River under commission plans, thereby officially adopting such plans for the inauguration of this work.

When the Mississippi River Commission began the work of improvement there were few, if any, precedents of practical value to serve as guides in a project of such magnitude. But very meager data as to the regimen of the river was available, and a thorough knowledge of its many varying phases was essential before satisfactory comprehensive plans of improvement could be developed. Exhaustive surveys and observations of the physics of the river from the headwaters to the mouth were therefore inaugurated and carried on until the data needed was secured and experiments with various kinds of plant and material were also made in order to develop the equipment and type of construction needed for efficient work. This work necessarily occupied several years. During these years the appropriations were comparatively small, and sometimes failed altogether, with disastrous results to the channel works, so progress was

necessarily slow. As a result of the knowledge of the regimen of the river acquired and the lessons taught by the experimental work, definite projects are now entered upon with confidence of success, but efforts looking to improved methods to secure greater efficiency and economy will be continued.

The earlier works were designed primarily for the rectification and improvement of the channel, and were confined to the Plum Point Reach, 147 to 186 miles, and Lake Providence Reach, 517 to 552 miles below Cairo. These reaches were selected because here the shifting sand bars and deficient depths were most pronounced and the low-water navigation most difficult. Highly beneficial results were obtained in the improvement of the channel depths in those reaches, and the work done in them confirmed the soundness of the theory upon which it was based, but also demonstrated that more substantial types of construction were needed and that the permanent improvement of the channel by contraction and revetment works would necessarily consume a long period of time, while the pressing needs of commerce called for immediate relief. The development in hydraulic dredging machinery had reached such a stage at this time as to hold out the hope that an immediate and economical solution of the problem of temporarily deepening the channel for navigation purposes might be found in the opening and maintenance of channels across the obstructing bars at each low-water season by means of dredging. After extended studies and experiments, hydraulic dredges of large capacity, adapted to the peculiar service required, were developed by the commission, and this method of temporary improvement of the low-water channel was adopted with a view to maintaining a navigable channel not less than 250 feet in width and 9 feet in depth, and has been applied with success.

Since the adoption of dredging, the permanent work of channel improvement has been confined to the revetment of banks, and a type of revetment has been developed which successfully withstands the scouring action of the river. Concrete has been largely substituted for the upper bank revetment, and its use for sinking the present type of willow mat, as well as a possible substitute for the mat itself, is receiving careful attention with a view to further economy and increased efficiency.

The extent of bank revetment is, however, relatively so great when compared to the funds available for its construction that it has been necessary to confine the work to cases of urgent necessity, such as caving banks which threaten cut-offs or the safety of large levees which could only be replaced at excessive cost, and the harbor fronts of cities. Substantial revetment for the purpose of fixing the banks of the river is essential to any successful scheme of improvement, and as the project adopted by Congress requires that the commission shall "correct, permanently locate, and deepen the channel, and protect the banks of the Mississippi River," largely increased expenditures for revetment construction are urgently needed. The sum of at least \$4,000,000 could be economically and judiciously expended on this work annually.

One of the important items in the operation of the commission is the general repair and construction of levees, which was first authorized without qualifying restrictions by the act of September 19, 1890,

and since that date about one-half of the appropriations made by Congress have been devoted to that purpose.

Briefly stated in general terms and quoting in part the several acts of Congress under which the project is being carried out, the work now in progress covering the Mississippi River from the mouth of the Ohio to the Head of the Passes, 1,060 miles, includes "Continuing improvement with a view to securing a permanent channel depth of 9 feet" by means of:

1. Revetment of caving banks to "correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River," and for the preservation of harbors and the security of levees.

2. Dredging, for the purpose of maintaining at all stages a "navigable channel 250 feet in width and 9 feet in depth," including construction, operation, and maintenance of suitable dredge boats and auxiliary devices and appliances therefor.

3. Construction, extension, and repair of levees from Cape Girardeau, Mo., to the Head of the Passes, 1,114 miles in cooperation with the several States and levee boards, to "prevent destructive floods" and "give safety and ease to navigation" of the Mississippi River at flood stages by facilitating the interchange of traffic, "commerce, trade, and the postal service."

4. The maintenance of a navigable channel between the waters of the Mississippi, Red, and Atchafalaya Rivers.

5. Physical investigations; maintenance of gauges and discharge measurements on the Mississippi River and its tributaries, preparation and publication of maps and physical data; surveys and investigations covering all phases of river regimen governing the work of channel improvement and flood control "from the headwaters of the Mississippi River to the Head of the Passes."

6. Other miscellaneous details incident to the execution of the general project.

LEVEE WORK ABOVE CAPE GIRARDEAU, MO.

The river and harbor act approved March 4, 1913, appropriated the sum of \$200,000 for the purpose of making an examination of the Mississippi River from Cape Girardeau, Mo., to Rock Island, Ill.—

with a view to such improvements as will at the same time promote navigation, develop water power, and protect property adjacent to said river from damage by floods; * * * and for the building of such levees between said points upon the river in aid of navigation as may be found necessary or desirable by the commission and approved by the Chief of Engineers.

The river and harbor act approved July 27, 1916, provides that—

any funds which are herein, or may hereafter be appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended, under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, for levees upon any part of said river between Head of Passes and Rock Island, Illinois, in such manner as, in their opinion, shall best improve navigation and promote the interests of commerce at all stages of the river.

The flood-control act approved March 1, 1917, provides in paragraph (c) of section 1 that—

any funds which may hereafter be appropriated under authority of this act for improving the Mississippi River between the Head of the Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended upon any part of said river between the Head of the Passes and Rock Island, Illinois.

EXTENSION OF JURISDICTION OF THE MISSISSIPPI RIVER COMMISSION.

The river and harbor act approved July 27, 1916, provides:

That the water courses connected with said river and the harbors upon it, now under the control of the Mississippi River Commission and under improvement, together with the harbor at Vicksburg, Mississippi, and the Ohio River from its mouth to the mouth of the Cache River, which are hereby transferred to and placed under the control and jurisdiction of such commission, may, in the discretion of said commission, upon approval by the Chief of Engineers, receive allotments for improvements now under way or hereafter to be undertaken, to be paid for from the amount herein appropriated:

* * * * *

Provided further, That no part of the improvement of the Ohio River, with a view to the construction of locks and dams, shall be considered as transferred to or placed under the control and jurisdiction of the Mississippi River Commission.

The same act provides that—

The jurisdiction of the Mississippi River Commission is hereby extended so as to include that part of the Arkansas River between its mouth and the intersection thereof with the division line between Lincoln and Jefferson Counties; and any funds which are herein or may be hereafter appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River and which may be allotted to levees and bank revetment may be expended within the limits of said extended jurisdiction, under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, and upon like terms and conditions for levees and bank revetment upon any part of the Mississippi River now under the jurisdiction of said commission, and in such manner as will best promote and accomplish the purposes for which the commission was created, in so far as the territory hereby added to its said jurisdiction may be involved.

The flood-control act, approved March 1, 1917, further provides:

That the watercourses connected with the Mississippi River to such extent as may be necessary to exclude the flood waters from the upper limits of any delta basin, together with the Ohio River from its mouth to the mouth of Cache River, may, in the discretion of said commission, receive allotments for improvements now under way or hereafter to be undertaken.

POLICY ADOPTED BY THE MISSISSIPPI RIVER COMMISSION FOR WORK UNDER
THE FLOOD-CONTROL ACT APPROVED MARCH 1, 1917.

The Mississippi River Commission must be governed by and rigidly conform to the terms of the flood-control act, and the hearty cooperation of all levee boards is looked for in order to carry on the work of levee construction in a satisfactory and economical manner.

The money to be appropriated under authority of the flood-control act is "for controlling the floods and for the general improvement of the Mississippi River," etc., and the amounts to be devoted to the construction of levees and other classes of work will, as heretofore, be determined by the Mississippi River Commission from time to time as appropriations are made and in accordance with policy of the commission as heretofore adopted.

Under the law the amount contributed by local interests for the construction or repair of any levee "shall not be less than one-half of such sums as may have been allotted by the commission." The commission will determine in each case what proportion is "just

and equitable" when the allotments of funds of successive appropriations are made. No funds can be expended by the commission under the flood-control act for levee work in any levee district "between the Head of the Passes and Rock Island, Illinois," unless the contribution of funds thereto required by law be first made.

The amounts contributed by local levee boards must be in current funds, deposited in the United States Treasury or acceptable depository to the credit of the Mississippi River Commission. In accordance with a ruling of the Treasury Department, interest accruing, if any, on such deposits may be payable by the depository to the levee boards which have made such deposits in compliance with the law.

The terms of the flood-control act prohibit the expenditure of funds for levee purposes in any levee district unless a minimum of one-third of the amount required is contributed by the said district.

No credit will be given to any levee district for work done or money expended on the construction of levees prior to the allotment of funds therefor by the commission from the appropriations authorized by the flood-control act, and contributions from levee boards required by law must be in current funds.

All levee construction and the disbursement of funds from commission allotments and the contributions from levee districts shall be under the direction of the Mississippi River Commission and its authorized agents.

No money allotted by the commission under authority of the flood-control act can be expended for right of way, but "all such rights of way must be provided free of cost to the United States" by the several levee districts. Furthermore, "no money paid as expenses incurred by any State or levee district in securing such right of way or in any temporary works of emergency, or for the maintenance of any levee line, shall be computed as a part of the contribution of such State or levee district" toward the allotment made by the commission.

The maintenance of a completed levee, constructed in whole or in part under the flood-control act, must be cared for by the levee district protected thereby.

Competent experienced engineers and inspectors in the service of the levee boards may be transferred to the service of the commission under civil-service regulations as the exigencies of the work may require.

Section (b) of the flood-control act provides that contributions from levee districts apply solely to the construction and repair of levees. Revetment work, therefore, is regarded as exempt from the ratio of contribution prescribed by this law.

A resolution passed by the Mississippi River Commission July 12, 1917, requires that each levee district on the Mississippi River under the control of the Mississippi River Commission be advised that the cash contribution for the construction of levees in such district, after an allotment of funds by the Mississippi River Commission under the provisions of the flood-control act approved March 1, 1917, must be made within 90 days after notice of such allotment, except where the commission specially authorizes other action.

APPROPRIATION AND ALLOTMENTS.

Since the creation of the Mississippi River Commission there has been appropriated and allotted for expenditure under it on the Mississippi River \$90,715,610.68. By the river and harbor act approved July 27, 1916, the sum of \$6,000,000 was appropriated for continuing improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, and for the construction of levees from the mouth of the Ohio River to Rock Island, Ill., including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission. On recommendation of the Mississippi River Commission this was allotted as follows:

SECRETARY.

Mississippi River Commission.....	\$50,000	
Surveys, gauges, and observations.....	60,000	
Dredges and dredging.....	250,000	
Levees—Cape Girardeau to Rock Island:		
Rock Island to New Boston, Ill.....	15,000	
Muscatine to mouth of Iowa River, Iowa.....	30,000	
Oquawka to Dallas, Ill.....	20,000	
Warsaw to Quincy, Ill.....	30,000	
La Grange to mouth of Missouri River, Mo.....	20,000	
Quincy to Hamburg Bay, Ill.....	70,000	
Head Chouteau Island to Prairie du Pont, Ill.....	25,000	
Grand Tower to Gale near Thebes, Ill.....	20,000	
		\$590,000

FIRST AND SECOND DISTRICTS.

Rrevetment:		
Gayoso, Mo.....	150,000	
Barfield, Ark.....	200,000	
Bullerton, Ark.....	150,000	
Porter Lake, Ark.....	105,000	
Old Town Bend, Ark.....	105,000	
General repairs and stone.....	50,000	
Plant:		
Concrete revetment plant.....	150,000	
Six barges.....	50,000	
St. Louis district revetment plant.....	60,000	
New wood barges and flats.....	37,000	
Care and repair of plant.....	75,000	
Surveys.....	5,000	
Levees:		
Upper St. Francis levee district.....	100,000	
Reelfoot levee district.....	40,000	
Lower St. Francis levee district.....	270,000	
White River levee district.....	100,000	
		\$1,647,000

THIRD DISTRICT.

Rrevetment:		
Cottonwood, Miss.....	240,000	
Panther Forest, Ark.....	70,000	
Bolivar.....	90,000	
Fitlers.....	9,000	
Red Fork, Ark.....	80,000	
Vicksburg, Miss.....	100,000	
Reid Bedford, La.....	100,000	
Ashbrook Neck, Miss.....	60,000	
General repairs and stone.....	60,000	
Plant:		
New.....	200,000	
Care and repair.....	66,000	

Surveys	\$5, 000
Ashbrook Neck Dike.....	232, 000
Levees:	
Lower Yazoo levee district.....	300, 000
Upper Tensas levee district.....	373, 000
	<hr/> \$1, 985, 000

FOURTH DISTRICT.

Revetment:	
Hard Times Bend.....	100, 000
Kempe.....	65, 000
Giles Bend.....	100, 000
Marèngo Bend.....	100, 000
Grand Bay.....	175, 000
Bondurant.....	35, 000
New Orleans.....	130, 000
General repairs and stone.....	23, 000
Plant:	
New.....	100, 000
Care and repair.....	60, 000
Surveys.....	5, 000
Levees:	
Lower Tensas levee district.....	350, 000
Atchafalaya levee district.....	150, 000
Lafourche levee district.....	100, 000
Barataria levee district.....	95, 000
Pontchartrain levee district.....	125, 000
Lake Borgne levee district.....	50, 000
Atchafalaya and Red Rivers.....	15, 000
	<hr/> 1, 778, 000
	<hr/> 6, 000, 000

From unallotted balance from refundments made in 1898 and 1900, an allotment of \$14.02 to the Mississippi River Commission was approved by the Assistant Secretary of War, November 24, 1916.

From the appropriation of \$6,000,000 carried in the sundry civil act of June 12, 1917, for carrying out the provisions of the flood-control act approved March 1, 1917, an allotment of \$5,660,000 was approved by the Secretary of War, June 22, 1917, for the work of the Mississippi River Commission.

The following reallootments of funds from appropriations and allotments, as reported in reports of the Mississippi River Commission for 1915, page 3476, and in this report, have been made during the year:

From allotment for Lower Tensas Levee district to Memphis Harbor..	\$26, 000
From allotment for Lake Bolivar to repairs to existing works and stone, third district.....	60, 000
From allotment for Upper Tensas Levee district to lower Yazoo Levee district.....	49, 000
From allotment for Marengo bend to Giles bend.....	10, 000
From allotment for Ashbrook neck to Upper Tensas Levee district.....	20, 000
From allotment for Cottonwood, Miss., to Upper Tensas Levee district..	20, 000
From allotment for Ashbrook Dike to Upper Tensas Levee district.....	20, 000
From allotment for Delta, Miss. (maintenance act of 1915), to new plant, first and second districts.....	15, 000

In addition to the above the sum of \$9,100 was allotted by the Chief of Engineers for the fiscal year ending June 30, 1917, from the permanent indefinite appropriation made by act of August 11, 1888, as amended by act of June 13, 1902, for gauging the waters of the Mississippi River and its tributaries, which is applied to the maintenance of certain river gauges.

Details of the expenditures of the various allotments are appended hereto.

MISSISSIPPI RIVER COMMISSION.

Commissioners.—The commissioners during the fiscal year were Col. C. McD. Townsend, Corps of Engineers, United States Army, president until June 8, 1917; Col. J. G. Warren, Corps of Engineers, United States Army, acting president from June 9, 1917; J. A. Ockerson, civil engineer; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Charles H. West, civil engineer; Col. Lansing H. Beach, Corps of Engineers, United States Army; and Edward A. Glenn.

Secretary and district officers.—The following officers of the Corps of Engineers, United States Army, were on duty under the commission during the year: Secretary, Maj. Clarke S. Smith; first and second districts officer, Maj. E. M. Markham, until August 12, 1916; Maj. Michael J. McDonough, until April 30, 1917; and Lieut. Col. G. P. Howell, from May 1, 1917; third district officer, Maj. John R. Slattery; fourth district officer, Maj. W. G. Caples, until November 30, 1916; Maj. Richard C. Moore, until April 29, 1917; Capt. Beverly C. Dunn, until May 10, 1917. Lieut. Col. G. McC. Derby, United States Army, retired, was on duty under the commission from May 11, 1917.

Sessions.—Four sessions of the commission were held during the fiscal year. The one hundred and thirty-fifth session, July 6-7, 1916, and the one hundred and thirty-sixth, August 9, 1916, were held in the offices of the commission, International Life Building, St. Louis, Mo. The one hundred and thirty-seventh session, November 9-21, 1916, and the one hundred and thirty-eighth, April 20-28, 1917, were held on board the steamer *Mississippi* during inspections of the river from Rock Island, Ill., to New Orleans, La., and from St. Louis, Mo., to New Orleans, La., respectively. At these sessions public hearings were given to representatives of the navigation, levee, commercial, and other interests of the river.

The following is a summary of the work of the commission:

SURVEYS, GAUGES, AND OBSERVATIONS.

The general survey of the Mississippi River has been completed from the Head of Passes to its headwaters and the maps and charts published. A resurvey of the river from Cairo to the mouth of Red River, a distance of 772 miles, was completed in 1914, the reduction of field notes and mapping has been completed, and a contract has been let for the publication of maps, scale 1 inch=1 mile, and charts, scale 1:20,000, of this survey.

The field work of the survey of the Atchafalaya River from Red River to Morgan City, La., was completed in March, 1917, and the reduction of field notes and mapping are in progress.

Discharge observations of the river and many of its tributaries have been made at high and low water, river and tide gauges maintained, and other physical data collected. (For details see Appendix 1.)

DREDGES AND DREDGING.

For the purpose of maintaining a channel at least 9 feet deep and 250 feet in width at all stages of the river, 10 dredges have been con-

structed. A navigable channel has been maintained since 1895, and a channel of project dimensions has been maintained since 1902, except as follows: For 18 days in 1903 and a few days in 1904, the depths at one bar were 8 and 8½ feet. For a few days there was less than 9 feet at five bars in 1908, seven bars in 1910, five bars in 1914, and two bars in 1916. For a few days at one bar in 1913, and four bars in 1916, the required width was not maintained.

The project depth of 9 feet with width of 250 feet was exceeded at all bars below Cairo at the end of the year.

During the dredging season of 1916, nine dredges were operated to maintain the project channel and harbor depths. A rapid fall in the stage of the river occurred during the latter part of August, and there was no material rise until near the end of December. The minimum stages of the year at Cairo and Memphis were 5.8 feet December 25 and 2.8 feet December 28, respectively. Dredges were in the field from August 9 to December 27. Actual dredging was commenced August 15 and was discontinued December 8. A slight rise at that time was followed by a lower stage accompanied by heavy running ice. When the ice had passed, a rapid rise made further dredging unnecessary.

On account of the formation of a mud bar in Memphis Harbor, temporary dredging necessary to provide access to the harbor was begun in May, 1915. To secure the permanent improvement of the harbor, dredging was begun January 11, 1916, for the excavation of a channel 3,000 feet long to divert water from the Mississippi River through the Loosahatchie and Wolf Rivers along the harbor front. A dam was constructed across the Wolf River Channel to assist in carrying out this plan. Work on the dam was begun in September, 1916, and was practically completed November 30.

Dredging in the channel was continued during the year, and up to November 30, 1916, a total of about 466,000 cubic yards of material had been removed. Access to the harbor was maintained during the year by dredging. (For details, see Appendixes 1 and 2.)

REVTMENT WORK.

There is summarized in the following table the total lengths of the existing revetments and the amounts constructed during the year.

Mississippi River, mouth of the Ohio River to Head of Passes—effective length of bank protection, June, 1917, and length built during the year.

Locality.	Miles below Cairo.	Bank of river.	Built during the year.	Revetment in place.
			<i>Lin. ft.</i>	<i>Lin. ft.</i>
Columbus, Ky.....	21	Left.....		2,200
Hickman, Ky.....	36	do.....		1,400
Slough Landing Neck, Tenn.....	60	do.....	764	16,364
New Madrid, Mo.....	71	Right.....		4,450
Gayoso Bend, Mo.....	106	do.....	5,578	5,578
Caruthersville, Mo.....	110	do.....		2,400
Barfield, Ark.....	141	do.....	3,475	3,475
Plum Point Reach:				
Daniels Point, Ark.....	152	do.....		
Ashport, Tenn.....	155-159	Left.....		
Fletchers Bend, Ark.....	158-161	Right.....		
Osceola, Ark.....	163-165	do.....		76,080
Bullerton Bar, Ark.....	168	do.....	2,960	

Mississippi River, mouth of the Ohio River to Head of Passes, etc.—Continued.

Locality.	Miles below Cairo.	Bank of river.	Built during the year.	Revetment in place.
			<i>Lin. ft.</i>	<i>Lin. ft.</i>
Golden Lake, Ark.....	192	Right.....		3, 010
Hopefield Bend, Ark.....	227-230	..do.....		14, 800
Memphis, Tenn.....	230-232	Left.....		14, 800
Tennessee Chute, Tenn.....	237	..do.....		1, 000
Star Landing, Miss.....	257	..do.....		7, 535
Porter Lake, Ark.....	261	Right.....	582	5, 822
Walnut Bend, Ark.....	281	..do.....		7, 160
Trotters Landing, Miss.....	304	Left.....		6, 625
Helena, Ark.....	306	Right.....		5, 000
Delta, Miss.....	315	Left.....	2, 165	7, 195
Old Town Bend, Ark.....	324	Right.....		6, 000
Sunflower, Miss.....	355	Left.....		9, 670
Red Fork, Ark., Arkansas River.....	402	Right.....		1, 200
Lake Bolivar Front.....	417	Left.....	1, 100	8, 640
Ashbrook Neck.....	446	..do.....		11, 150
Panther Forest.....	452	Right.....	1, 780	7, 400
Leland Neck, Ark.....	471	..do.....		5, 000
Greenville, Miss.....	478	Left.....	1, 070	21, 670
Vauchuse, Ark.....	487	Right.....		3, 925
Longwood, Miss.....	500	Left.....		4, 200
Grand Lake, Ark.....	510	Right.....		8, 500
Lake Providence Reach:				
Louisiana Bend.....	522	..do.....		11, 300
Lake Providence, La.....	540	..do.....		12, 600
Fittlers Bend, Miss.....	550	Left.....	1, 300	8, 450
Cottonwood, Miss.....	558	..do.....	8, 060	8, 060
Albemarle Bend, Miss.....	568	..do.....		13, 720
Delta Point, La.....	598	Right.....		5, 900
Vicksburg, Miss.....	599	Left.....	1, 800	1, 800
Reid-Bedford Bend, La.....	603	Right.....	530	6, 810
Hard Times Bend, La.....	633	..do.....		7, 689
Bondurant.....	643	..do.....		4, 150
Kempe.....	658	..do.....		28, 616
Giles Bend.....	687-691	Left.....	300	20, 917
Marengo Bend.....	693	Right.....		12, 844
Natchez Front.....	700	Left.....		3, 536
Grand Bay.....	808	Right.....	3, 180	3, 180
Plaquemine, La.....	854	..do.....		6, 370
Avondale, La.....	953	..do.....		1, 615
New Orleans Harbor.....	960-970			
Carrollton.....		Left.....		13, 630
Greenville.....		Right.....		13, 310
Gretna Front.....		..do.....		5, 010
Gouldsboro-Algiers.....		..do.....		9, 475
Third district.....		Left.....		13, 700
Total.....			¹ 34, 644	² 484, 931

¹ 6.56 miles.² 91.84 miles.

RIVER STAGES DURING THE YEAR.

The stage of the Mississippi River remained moderately high until the latter part of July. During August a fall of 7 feet at Cairo was followed by a rise which reached 25.4 on that gauge August 20. From September 1 to the end of December a moderately low stage prevailed without much variation. The gauge reading at Cairo was below 14 feet 28 days during September, and below 10 feet 24 days in October, and 23 days in November. A stage of 13.2 at Cairo December 14 was followed by the lowest stage of the year, reading 5.8 at Cairo December 25. A rapid rise began during the last few days of December, and moderately high stages have prevailed since that time. The maximum reading at Cairo during 1917 was 49.95 April 4 and 5. This reading is 4.74 lower than the previous highest, which occurred in 1913. A stage of 32.9 at St. Louis June 14 resulted from moderately high stages on the upper Mississippi combined with flood stages on the Missouri River. (For details see Appendix 1.)

LEVEES.

For convenience in administration and allotment of funds for levee purposes the river front below Cape Girardeau, Mo., has been divided by the commission into levee districts. The names and locations of these districts as now established by the commission are as given on pages 3718-3719 of report of the Chief of Engineers for 1912. Levee construction from Cape Girardeau, Mo., to Rock Island, Ill., as provided for by the river and harbor act approved July 27, 1916, is in charge of the secretary, Mississippi River Commission.

The following table, which is similar to that given in previous reports, has been brought up to date and shows the present condition of levees below Cape Girardeau and levee operations during the past year, as compiled from the reports of the district officers:

Levee district.	In system.	Built.	Contents, 1916.	Built since by United States.	Built since by local authorities.	Total built since 1916.
	<i>Miles.</i>	<i>Miles.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>
Upper St. Francis.....	87	67	5,784,803	84,961	511,539	596,500
Lower St. Francis.....	218	211	40,736,993	869,119	2,263,030	3,132,149
White River.....	74	74	15,275,504	545,978	372,789	918,767
Reelfoot.....	21	21	2,486,349	76,769	156,250	233,019
Upper Yazoo.....	124	124	36,895,009		1,622,783	1,622,783
Lower Yazoo.....	206.30	185.20	51,836,527	1,371,564	1,896,423	2,267,987
Upper Tensas.....	192	190.60	48,726,244	1,070,219	1,527,964	2,598,183
Lower Tensas.....	157.29	150.34	30,094,155	529,076	² 1,104,699	1,633,775
Atchafalaya.....	127.87	127.87	25,268,582	509,967	³ 182,934	692,901
Lafourche.....	82.14	82.14	12,020,411	247,017	884,482	1,131,499
Barataria.....	71.12	71.12	4,539,656	137,511	189,281	326,792
Pontchartrain.....	125.33	125.33	21,688,706	461,224	⁴ 443,361	904,585
Lake Borgne.....	79.29	79.29	5,426,347	101,382	167,752	269,134
Total.....	1,565.34	1,508.89	300,779,286	6,004,787	10,323,287	16,328,074

Levee district.	Lost or abandoned during the year.	Contents, 1917.	Required to complete.	Estimated final contents.	Per cent now built.	Approximate area protected.
	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>	<i>Cubic yds.</i>		<i>Sq. mi.</i>
Upper St. Francis.....		6,381,303	7,913,136	14,294,439	44.6	700
Lower St. Francis.....		43,869,142	8,139,858	52,009,000	84.2	3,500
White River.....	141,608	16,052,663	12,458,337	28,511,000	56.3	910
Reelfoot.....		2,719,368	1,308,632	4,028,000	67.5	310
Upper Yazoo.....	411,400	38,106,392	3,525,608	41,632,000	91.5	3,281
Lower Yazoo.....	833,000	53,271,514	33,773,263	87,044,777	61.2	3,367
Upper Tensas.....	220,000	51,104,427	24,762,817	75,867,244	67.4	2,500
Lower Tensas.....	775,957	30,951,973	15,601,721	46,553,694	66.5	2,080
Atchafalaya.....	214,800	25,746,683	14,879,733	40,626,416	63.4	6,085
Lafourche.....	517,071	12,634,839	4,628,217	17,263,056	73.2	2,020
Barataria.....	74,015	4,792,433	968,265	5,760,698	83.2	
Pontchartrain.....	167,785	22,425,506	10,151,822	32,577,328	68.8	1,816
Lake Borgne.....	95,309	5,600,172	792,584	6,392,756	87.6	
Total.....	3,450,945	313,656,415	138,903,993	452,560,408	69.3	26,569

¹ 263,387 cubic yards of sublevees not included.

² Does not include 26,000 cubic yards in a drainage ditch.

³ Does not include 38,700 cubic yards placed in new levee at Bella Vista by the local authorities.

⁴ Does not include 68,700 cubic yards placed in the new Sarpy Levee, as the old levee is still the controlling levee line.

The column "Estimated final contents" of the levees given above is based on grades as revised on April 19, 1914, and sections provisionally established by the commission.

No levee work has been done in the Homochitto levee district by the United States, except closing crevasses in levees already existing

as provided for by joint resolution of Congress approved April 30, 1912.

The \$200,000 appropriated for examination and for levee construction from Cape Girardeau, Mo., to Rock Island, Ill., has been placed under contract and about 90 per cent of the work completed. For additional work in this district, \$230,000 was allotted from funds provided by the river and harbor act of July 27, 1916. Work has been contracted for in three districts aggregating \$47,080, and is about 15 per cent completed.

Two types of levee machine have been constructed by the commission, and are in successful operation, one of the cableway type in the third district and three of the derrick type in the fourth. In addition, several contractors have installed similar machines, and the lower prices which have been recently received for levee construction may in part be ascribed to the competition caused thereby. As a result of this development of a suitable machine for levee construction, the amount of levee work that can be done annually is practically limited only by the amount of funds available therefor. (For details, see Appendixes 2, 3, and 4.)

The expenditures for high-water protection were exceptionally light, which is due to the fact that the levees are nearer to a stage of completion than during former floods. A total of \$27,750.98 was, however, expended by the United States for high-water protection of levees during the flood of 1917. The amounts expended by local authorities have not yet been reported to the commission.

The total area overflowed was 1,734 square miles, all of which was due to backwater. This includes 19 square miles overflowed by crevasses in Laconia Circle Levee.

Further details as to the condition of levees and effect of flood are given in the following table:

Effect of flood of 1917 on levee system, etc.

Levee district.	Area of land overflowed.	Area of land saved from overflow by levees.	Cost of high-water protection to the United States.	Length of levees below commission grade.
	<i>Sq. mi.</i>	<i>Sq. mi.</i>		<i>Miles.</i>
Upper St. Francis.....	202	498		52.0
Lower St. Francis.....	100	3,400		91.0
White River.....	1 252	658		57.0
Reelfoot.....		310		17.0
Upper Yazoo.....		3,281		33.0
Upper Tensas.....	372	2,628	\$12,737.25	179.8
Lower Yazoo.....	808	2,559	12,737.25	170.6
Lower Tensas.....		2,080	2,276.48	135.79
Atchafalaya.....		6,085		120.61
Lafourche.....		2,020		71.93
Barataria.....				40.62
Lake Borgne.....		1,816		35.89
Pontchartrain.....				117.77
Total.....	1,734	25,335	27,750.98	1,123.01

¹ Includes 19 square miles in Laconia Circle overflowed by crevasses of 1916.

More substantial construction and more rigid supervision of the Arkansas River levees must be secured, and the Red Fork Levee must be connected with the main controlling levee above Arkansas City before satisfactory flood protection for the Tensas Basin can be realized.

CONDITION OF CHANNEL AT END OF FISCAL YEAR.

With the exception of rare periods of brief duration, there is now in the Mississippi River a good navigable channel at all stages of river, with a depth of 9 feet or more and a width of at least 250 feet for a distance of 833 miles below Cairo, and a depth of not less than 30 feet, with a width of several hundred feet at all times for the remaining 227 miles to the Head of Passes. There is an ample navigable channel at least 14 feet in depth from Cairo to the Gulf of Mexico during five to eight months of each year when high stages of river prevail.

The following are depths and widths for the different stretches of the river below Cairo that can usually be relied upon during the lowest stages of the year:

Cairo to Memphis, Tenn., 230 miles, least depth 9 feet for width of 250 feet. Low-water channel maintained by dredging.

Memphis to Vicksburg, Miss., 370 miles, least depth 9 feet for width of 250 feet. Low-water channel maintained by limited amount of dredging.

Vicksburg to Baton Rouge, La., 233 miles, least depth 11 feet for width of 250 feet or more. Low-water channel maintained by a limited amount of dredging at rare intervals.

Baton Rouge to New Orleans, La., 134 miles, least depth 35 feet for width of several hundred feet. No dredging.

New Orleans to Quarantine Station, La., 92 miles, least depth 62 feet for width of several hundred feet. No dredging.

At mean low water there is an available depth of 31½ feet to the Gulf through South Pass and 24 feet through Southwest Pass, as reported by the district engineer officer, New Orleans, La.

RECOMMENDED APPROPRIATIONS AND ESTIMATE OF FUNDS REQUIRED.

The views of the commission as to the funds needed for the successful prosecution of the adopted project of improvement were set forth in its annual report for 1914.

Amount that can be profitably expended in the fiscal year ending June 30, 1919, exclusive of the balance unexpended July 1, 1918.

For continuing the general improvement of the Mississippi River from the Head of Passes to the mouth of the Ohio River, for the building of levees from the Head of Passes to Rock Island, Ill., and for surveys, including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission, \$12,000,000.

WM. H. BIXBY,

*Brigadier General, United States Army, Retired,
President Mississippi River Commission.*

J. A. OCKERSON,
Civil Engineer.

HOMER P. RITTER,
Assistant, United States Coast and Geodetic Survey.

J. G. WARREN,
Colonel, Corps of Engineers, United States Army.

C. H. WEST,
Civil Engineer.

LANSING H. BEACH,
Colonel, Corps of Engineers, United States Army.

EDWARD A. GLENN.

Money statements.

APPROPRIATIONS EXPENDED UNDER MISSISSIPPI RIVER COMMISSION.

Appropriation for improving Mississippi River.

July 1, 1916, balance unexpended.....	¹ \$146, 910. 92
Amount appropriated by River and Harbor Act July 27, 1916.....	6, 000, 000. 00
Miscellaneous receipts from sales of Engineer property, rentals, depreciation of plant used at South Pass, Mississippi River.....	30, 879. 32
	<hr/> 6, 177, 790. 24
June 30, 1917, amount expended during fiscal year.....	2, 659, 786. 52
	<hr/>
July 1, 1917, balance unexpended.....	3, 518, 003. 72
July 1, 1917, outstanding liabilities.....	\$483, 015. 84
July 1, 1917, amount covered by uncompleted contracts.....	1, 243, 122. 26
	<hr/> 1, 726, 138. 10
	<hr/>
July 1, 1917, balance available.....	1, 791, 865. 62
	<hr/>
Distributed as follows:	
Mississippi River Commission.....	\$13, 571. 99
Surveys, gages and observations.....	13, 730. 95
Levees, Cape Girardeau, Mo., to Rock Island, Ill.....	207, 460. 57
Levees, Head of the Passes to Cape Girardeau, Mo.....	540, 369. 33
Revetment and contraction works, permanent channel improve- ment and protection.....	658, 508. 09
Dredges and dredging.....	64, 350. 21
Plant and miscellaneous.....	170, 175. 61
Improving harbors and tributaries except Vicksburg harbor.....	103, 253. 83
Improving Vicksburg Harbor.....	20, 445. 04
	<hr/> 1, 791, 865. 02

AMOUNT THAT CAN BE PROFITABLY EXPENDED IN FISCAL YEAR ENDING JUNE 30, 1919.

For continuing the general improvement of the Mississippi River from the Head of the Passes to the mouth of the Ohio River, for the building of levees from the Head of the Passes to Rock Island, Ill., and for surveys, including salaries, clerical, office, traveling and miscellaneous expenses of the Mississippi River Commission..... \$12, 000, 000. 00

¹ The amount, \$127,075.32, reported in annual report for 1916, has been increased \$19,835.60 by the fourth district officer by transfer from allotment for "Ashbrook Diike," third district, act of Mar. 4, 1915, credited to allotment for "Atchafalaya levee district," fourth district, Improving Mississippi River (ED 71814-248).

APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND
HARBOR WORKS.

July 1, 1916, balance unexpended—

Under act of Oct. 2, 1914-----¹\$580,913.22Under act of Mar. 4, 1915-----²2,009,061.31³\$2,589,974.53¹The amount, \$580,910.47, reported in annual report for 1916, has been increased \$2.75 by refundments, as follows:

By the secretary—

October, 1916, vouchers 119, 188, 189, 190, and 191, in January, 1916, \$0.15, \$0.35, \$0.35, \$0.20, respectively (to surveys, gages, and observations)-----\$1.25

October, 1916, voucher 66, January, 1916 (to dredges and dredging)-----1.10

February, 1917, voucher 66, January, 1916, \$0.15, and February, 1917, voucher 208, April, 1916, \$0.25 (to dredges and dredging)-----40

By the third district officer—

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to Lower Yazoo levee district)-----1.00

2.75

²The amount, \$2,027,638.08, reported in annual report for 1916, has been decreased \$18,576.77, as follows:

Increased by refundments—

By the secretary—

August, 1916, voucher 9, December, 1915 (to Mississippi River Commission)-----\$0.75

October, 1916, vouchers 63 and 64, March, 1916, \$0.40 and \$0.25, respectively (to Mississippi River Commission)-----65

October, 1916, vouchers 24, 25, 28, 54, 94, and 96, March, 1916, \$0.10, \$0.10, \$0.30, \$0.25, \$0.10, and \$0.10, respectively (to surveys, gages, and observations)-----95

February, 1917, vouchers 60, 61, and 62, March, 1916, \$0.15 each, respectively, and voucher 31, April, 1916, \$0.25 (to surveys, gages, and observations)-----70

October, 1916, voucher 65, March, 1916 (to dredges and dredging)-----15

By the first and second districts officer—

August, 1916, voucher 72, May, 1916 (to Lower St. Francis levee district)-----20

July, 1916, voucher 27, March, 1916 (to White River levee district)-----45

August, 1916, vouchers 99 and 100, May, 1916 (to Delta, Miss.)-----40

July, 1916, voucher 100, January, 1916 (to plant)-----24

By the third district officer—

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to Panther Forest, Ark.)-----20

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to Greenville, Miss.)-----1.00

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to Grand Lake, Ark.)-----1.48

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to plant)-----50

By the fourth district officer: August, 1916, voucher 47, January, 1916 (to Barataria levee district)-----2.33

\$10.00

Increased by transfer from allotment for "Delta, Miss." first and second districts, credited to allotment for "New Plant," first and second districts, act of Mar. 4, 1915 (ED 15927-519)-----

15,000.00

Increased by transfer from allotment for "Delta, Miss." first and second districts, credited to allotment for "Memphis Harbor," first and second districts, act of Mar. 4, 1915 (ED 15927-520)-----

25,000.00

Increased by reimbursement from Fifth Louisiana levee district for cutting drainage ditch, credited to allotment for "Lower Tensas levee district," fourth district (ED 100210-225)-----

1,109.20

Increased by reimbursement from allotment for South Pass Channel, Mississippi River, appropriation for maintenance and improvement of existing river and harbor works credited to allotment for "Harbor at New Orleans, La.," fourth district (ED 30157-275)-----

139.63

41,258.83

Decreased by transfer from allotment for "Delta, Miss." first and second districts, credited to allotments for "New Plant," \$15,000 and "Memphis Harbor," \$25,000, first and second districts, act of Mar. 4, 1915-----

40,000.00

Decreased by transfer from allotment for "Ashbrook Dike," third district, act of Mar. 4, 1915, credited to allotment for "Atchafalaya levee district," fourth district, Improving Mississippi River (ED 71814-248)-----

19,835.60

18,576.77

³The amount, \$2,608,548.55, reported in annual report for 1916, has been decreased \$18,574.02 by refundments, etc., as shown in footnotes ¹ and ² above.

3426 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1917.

Miscellaneous receipts from sales of Engineer property, etc.:

Under act of Oct. 2, 1914-----	\$0. 00	
Under act of Mar. 4, 1915-----	19, 812. 67	\$19, 812. 67
		<hr/>
		2, 608, 787. 20
June 30, 1917, amount expended during fiscal year:		
Under act of Oct. 2, 1914-----	226, 190. 53	
Under act of Mar. 4, 1915-----	1, 554, 336. 40	1, 820, 526. 93
		<hr/>
July 1, 1917, balance unexpended:		
Under act of Oct. 2, 1914-----	314, 722. 69	
Under act of Mar. 4, 1915-----	474, 537. 58	789, 260. 27
		<hr/>
July 1, 1917, outstanding liabilities:		
Under act of Oct. 2, 1914-----	\$15, 093. 53	
Under act of Mar. 4, 1915-----	111, 447. 62	126. 541. 15
		<hr/>
July 1, 1917, amount covered by uncompleted contracts:		
Under act of Oct. 2, 1914-----	42, 260. 83	
Under act of Mar. 4, 1915-----	219, 648. 19	261, 909. 02
		<hr/>
		388, 450. 17
		<hr/>
July 1, 1917, balance available:		
Under act of Oct. 2, 1914-----	188, 181. 54	
Under act of Mar. 4, 1915-----	212, 628. 56	400, 810. 10
		<hr/>

Distributed as follows:

Mississippi River Commission-----	248. 71	
Surveys, gauges, and observations-----	22, 292. 50	
Levees, Head of the Passes to Cape Girardeau, Mo-----	212, 931. 50	
Revetment and contraction works, permanent channel improvement and protection-----	31, 997. 30	
Dredges and dredging-----	94, 337. 85	
Improving harbors and tributaries except Vicksburg harbor-----	• 39, 002. 24	400. 810. 10
		<hr/>

APPROPRIATION FOR GAUGING WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.¹

July 1, 1916, balance unexpended-----	\$1, 631. 70
Amount allotted by Chief of Engineers, from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902-----	9, 100. 00
	<hr/>
	10, 731. 70
June 30, 1917, amount expended during fiscal year-----	\$8, 313. 92
June 30, 1917, amount reverted to Treasury during fiscal year-----	646. 09
	<hr/>
	8, 960. 01
	<hr/>

¹ The custody and care of the gauges maintained under this appropriation were assumed by the Mississippi River Commission Feb. 11, 1901, on which date they were transferred to the secretary, under authority of Secretary of War, dated Jan. 25, 1901.

² The amount, \$1,630.65, reported in annual report for 1916, has been increased \$1.05 by the Secretary, by refundments for overpayments, as follows:

October, 1916, voucher 124, March, 1916 (reverted to Treasury)-----	\$0. 40
February, 1917, voucher 32, April, 1916 (reverted to Treasury)-----	. 65
	<hr/>

MISSISSIPPI RIVER COMMISSION.

3427

July 1, 1917, balance unexpended	\$1,771.69
July 1, 1917, outstanding liabilities	906.59
July 1, 1917, balance available	865.10
Amount that can be profitably expended in fiscal year ending June 30, 1919	9,100.00

ITEMIZED STATEMENT OF EXPENDITURES DURING THE FISCAL YEAR ENDING JUNE 30, 1917, SUBMITTED IN COMPLIANCE WITH REQUIREMENT OF SECTION 6 OF RIVER AND HARBOR ACT OF AUG. 11, 1888.

Observations: Pay of permanent gauge observers	\$3,568.50
Inspections and repairs:	
Inspection of gauges on Mississippi River by junior engineers and parties on steamers	\$1,602.16
Inspection of gauges on tributaries	205.19
Renewals and repairs of gauges and bulletins	161.96
	1,969.31
Office expenses and contingencies:	
Pay of assistant and junior engineers, surveyors, and clerks	2,214.12
Stationery, printing, office rent, etc.	561.99
	2,776.11
Total	8,313.92

APPROPRIATION FOR FLOOD CONTROL, MISSISSIPPI RIVER, AND SACRAMENTO RIVER, CAL., 1918.

Allotment, June 20, 1917, from appropriation by sundry civil act of June 12, 1917	\$5,660,000.00
July 1, 1917, balance unexpended	5,660,000.00

APPROPRIATION FOR IMPROVING YAZOO RIVER AND TRIBUTARIES, MISS.

July 1, 1916, balance unexpended	\$14,722.52
June 30, 1917, expended in fiscal year	14,722.52

CONTRIBUTED FUNDS.

For improvement of Mississippi River in upper St. Francis levee district	\$234,000.00
June 30, 1917, expended in fiscal year	\$26,734.69
July 1, 1917, amount covered by uncompleted contracts	207,265.31
	234,000.00
For improvement of Mississippi River at Gayoso Bend, Mo	150,000.00
June 30, 1917, expended in fiscal year	150,000.00
For improvement of Mississippi River in the Reelfoot levee district (Kentucky)	25,000.00
June 30, 1917, expended in fiscal year	25,000.00

CONSOLIDATED STATEMENT OF ALL APPROPRIATIONS EXPENDED UNDER THE MISSISSIPPI RIVER COMMISSION TO JUNE 30, 1917.

APPROPRIATION FOR IMPROVING MISSISSIPPI RIVER.

Act of June 28, 1879 (organic)	\$175,000.00
Act of June 16, 1880 (sundry civil)	150,000.00
Act of Mar. 3, 1881 (river and harbor)	1,000,000.00

¹ The amount, \$14,722.52, unexpended, reported in annual report 1916, transferred Oct. 9, 1916, to district engineer officer, Vicksburg, Miss., district, under provision of river and harbor act July 27, 1916. (ED 7716-38.)

² The amount, \$200,000, reported in annual report for 1916, has been increased by additional deposits of \$34,000.

Act of Mar. 3, 1881 (sundry civil)	\$150,000.00
Act of Aug. 2, 1882 (river and harbor)	4,123,000.00
Act of Aug. 7, 1882 (sundry civil)	150,000.00
Act of Mar. 3, 1883 (sundry civil)	150,000.00
Act of Jan. 19, 1884	1,000,000.00
Act of July 5, 1884 (river and harbor)	75,000.00
Act of July 5, 1884 (river and harbor), less \$5,000 transferred to snag-boat service	2,065,000.00
Act of July 7, 1884 (sundry civil)	75,000.00
Act of Aug. 5, 1886 (river and harbor), less \$5,942.60 for expenses, office, Chief of Engineers	1,994,057.40
Act of Aug. 5, 1886 (river and harbor), less \$47.30 for expenses, office, Chief of Engineers	29,952.70
Act of Aug. 11, 1888 (river and harbor), less \$4,859 for expenses, office, Chief of Engineers	2,840,141.00
Act of Aug. 11, 1888 (river and harbor)	75,000.00
Act of Oct. 2, 1888 (sundry civil)	35,000.00
Act of Oct. 19, 1888 (deficiency), less \$4,214.39 reverted to the Treasury	20,785.61
Act of Sept. 19, 1890 (river and harbor)	3,200,000.00
Act of Sept. 30, 1890 (deficiency)	5,625.00
Act of Mar. 3, 1891 (deficiency)	1,950.00
Joint resolution approved Mar. 3, 1891 (Public, No. 19)	1,000,000.00
Act of July 13, 1892 (river and harbor)	2,470,000.00
Act of July 28, 1892 (deficiency)	44.80
Act of Mar. 3, 1893 (sundry civil)	2,665,000.00
Act of Aug. 18, 1894 (river and harbor)	485,000.00
Act of Aug. 18, 1894 (sundry civil)	2,665,000.00
Act of Mar. 2, 1895 (sundry civil)	2,665,000.00
Act of June 3, 1896 (river and harbor)	909,000.00
Joint resolution approved Mar. 31, 1897 (Public, No. 6)	250,000.00
Act of June 4, 1897 (sundry civil)	2,933,333.00
Act of July 19, 1897 (deficiency)	625,000.00
Act of July 1, 1898 (sundry civil)	1,983,333.00
Act of Mar. 3, 1899 (sundry civil)	2,583,333.00
Act of Mar. 3, 1899 (river and harbor)	185,000.00
Act of June 6, 1900 (sundry civil), less \$5,000 for expenses, office Chief of Engineers	2,245,000.00
Act of June 13, 1902 (river and harbor)	2,200,000.00
Act of Mar. 3, 1903 (sundry civil)	2,000,000.00
Act of Apr. 28, 1904 (sundry civil)	2,000,000.00
Act of Mar. 3, 1905 (river and harbor)	1,000,000.00
Act of Mar. 3, 1905 (sundry civil)	2,000,000.00
Act of June 30, 1906 (sundry civil)	2,000,000.00
Act of Mar. 2, 1907 (river and harbor)	3,000,000.00
Act of May 27, 1908 (sundry civil)	2,000,000.00
Act of Mar. 4, 1909 (sundry civil)	2,000,000.00
Act of June 25, 1910 (sundry civil)	2,000,000.00
Act of June 25, 1910 (river and harbor)	2,000,000.00
Act of Feb. 27, 1911 (river and harbor)	3,000,000.00
Act of July 25, 1912 (river and harbor), less \$1,443,944.83 expended for rebuilding levees, under joint resolution of Apr. 30, 1912	4,556,055.17
Act of July 25, 1912 (river and harbor)	30,000.00
Act of Mar. 4, 1913 (river and harbor)	6,000,000.00
Act of Mar. 4, 1913 (river and harbor)	200,000.00
Act of July 27, 1916 (river and harbor)	6,000,000.00
Total specific appropriations	82,965,610.68
Balances from former appropriations applied to works below Cairo under act of Aug. 2, 1882, less \$123.42 reverted to Treasury	\$272,504.96
Same for works above Cairo, under act of July 5, 1884	22,632.53
Total balances	295,137.49

Amount, \$15.76, arising from refundments pertaining to extinct or unknown allotments, less debit of Treasury settlement No. 13704, Dec. 26, 1900, as reported by the Chief of Engineers, U. S. Army, June 23, 1916, and credited to allotment for "Mississippi River Commission," December, 1916-----

\$14.02

Miscellaneous receipts:

Previously reported----- \$108,255.13

Amounts received from sales of Engineer property and stores, under the provisions of section 5 of river and harbor act of June 13, 1902, and sales of contact prints:

By the secretary—

From sale of Engineer property in March, 1917, credited to allotment for "Dredges and dredging"----- 1,000.50

By first and second districts officer—

From sales of blue prints, credited to allotment for "Surveys," in months named—

September, 1916----- 3.82

December, 1916----- .50

From sale of Engineer property in August, 1917, credited to allotment for "Plant"-----

380.50

By third district officer—

From sales of Engineer property, credited to allotment for "Plant," in months named—

May, 1917----- 37.12

June, 1917----- 90.00

From sales of contact prints, credited to allotment for "Upper Tensas levee district," in months named—

December, 1916----- .30

February, 1917----- .45

By fourth district officer—

From sales of blue prints, credited in June, 1917, to allotments named—

"Surveys, gages, and observations"----- 6.10

"Lower Tensas levee district"----- 2.50

"Atchafalaya levee district"----- 1.25

"Harbor at New Orleans, La."----- .48

Amount received in November, 1916, from sale of steamer Wynoka (ED. 87050-421 Sec. MRC 2284-10) credited to "Dredges and dredging," Secretary's office-----

20,000.00

Amount received in September, 1916, from rental of tug *White Water*, credited to allotment for "Cottonwood, Miss.," third district-----

10.00

Amount received in December, 1916, for depreciation of plant employed on works at Head of Passes, from allotment for South Pass Channel, Mississippi River (Appropriation for Maintenance and Improvement of Existing River and Harbor Works ED. 30157-275 and 104191-18) credited in March, 1917, to "Plant," fourth district-----

2,284.42

Amounts received for depreciation of plant employed at Head of Passes, Mississippi River (ED. 30157-275) credited to allotments indicated in months named:

April, 1917, to "Plant," fourth district----- 3,421.06

May, 1917, to "Plant," fourth district----- 323.52

May, 1917, to "Harbor at New Orleans, La."----- 3,316.80

Miscellaneous receipts—Continued.

Amount received in February, 1917, for construction of steel barge, third district, allotment for "Ashbrook Dike," act of Mar. 4, 1915, credited to allotment for "Atchafalaya levee district," fourth district (ED. 71814-248)----- \$21, 075. 90

Total miscellaneous receipts----- \$160, 210. 35

Total----- 83, 420, 972. 54

Expended.

Location and object.	To June 30, 1916.	During year ending June 30, 1917.	Total.
Mississippi River Commission.....	\$1, 046, 872. 26	\$34, 879. 21	\$1, 081, 751. 47
Surveys, gauges, and observations.....	3, 027, 742. 29	53, 853. 53	3, 081, 595. 82
Examination from Cape Girardeau Mo. to Rock Island, Ill.....	8, 621. 54	1, 378. 46	10, 000. 00
Levees, Cape Girardeau, Mo., to Rock Island, Ill.....	146, 926. 53	11, 764. 14	158, 690. 67
Levees, Head of the Passes to Cape Girardeau, Mo.....	32, 343. 796. 42	545, 206. 01	32, 889, 002. 43
Revetment and contraction works, permanent channel improvement and protection.....	17, 148, 622. 02	1, 247, 368. 57	18, 395, 990. 59
Dredges and dredging.....	6, 779, 680. 71	110, 290. 09	6, 889, 970. 80
Experimental dikes.....	100, 000. 00		100, 000. 00
Plant and miscellaneous.....	5, 935, 066. 94	523, 120. 86	6, 458, 187. 80
Improving harbors and tributaries, except Vicksburg Harbor.....	9, 355, 240. 08	61, 966. 29	9, 417, 206. 37
Improving Vicksburg Harbor.....	582, 980. 98	69, 959. 36	652, 940. 34
Examination and survey of lands subject to overflow, east bank, Mississippi River.....	22, 401. 94		22, 401. 94
Works above Cairo.....	737, 632. 53		737, 632. 53
Total expended.....	77, 235, 584. 24		79, 895, 370. 76
To surplus fund.....			27, 598. 06
Balance unexpended June 30, 1917.....		2, 659, 786. 52	3, 518, 003. 72
Total appropriated, etc.....			3, 420, 972. 54

¹ The amount, \$32,342,556.12, reported in Annual Report for 1916, has been increased \$1,240.30, expenditures for construction of steel barge transferred from third district, allotment for "Ashbrook Dike." (ED. 71814-248.)

² Unexpended balance of the specific appropriation by act of July 25, 1912, for examination and survey of lands subject to overflow, east bank, Mississippi River, carried to surplus fund June 30, 1914. (ED. 15927-414, Sec. MRC. 2000-1.)

APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND HARBOR WORKS.

Act of Oct. 2, 1914 (allotment Oct. 7, 1914)----- \$3, 750, 000. 00

Act of Mar. 4, 1915 (allotment Apr. 2, 1915)----- 4, 000, 000. 00

Total specific appropriations----- 7, 750, 000. 00

Miscellaneous receipts:

Previously reported----- \$12, 666. 41

Amount received in Sept., 1916, from sale of sacks, credited to third district allotments as follows:

"Upper Tensas levee district"----- 6, 300. 00

"Lower Yazoo levee district"----- 6, 300. 00

Amount received in July, 1916, from sale of unused sacks, credited to allotment for "Lower Tensas levee district," fourth district----- 260. 00

Amount received from depreciation of plant employed on works at Head of Passes, from allotment for South Pass Channel, Mississippi River (appropriation for maintenance and improvement of existing river and harbor works) credited to allotment for "Harbor at New Orleans, La." fourth district, in months named—

September, 1916----- 846. 21

March, 1917----- 1, 545. 15

Miscellaneous receipts—Continued.

Amount received in October, 1916, from sale of lumber credited to allotment for "Pontchartrain levee district," fourth district-----	\$10.00	
Amounts received from sales of Engineer property under provisions of section 5 of river and harbor act of June 13, 1902, and sales of contact prints—		
By the secretary—		
From sale of blue prints in December, 1916, credited to allotment for "Surveys, gauges, and observations"-----	.79	
By first and second district officers—		
From sale of blue prints in October, 1916, credited to allotment "White River levee district"-----	.45	
By third district officer—		
From sales of Engineer property credited to allotment for "Plant" in months named—		
July, 1916-----	2,115.25	
August, 1916-----	10.00	
From sale of contact print in July, 1916, credited to allotment for "Plant"-----	.30	
By fourth district officer—		
From sale of Engineer property in July, 1916, credited to allotment for "Plant," fourth district-----	2,378.69	
From sales of blue prints credited to allotments indicated in months named—		
September, 1916, "Surveys"-----	12.50	
September, 1916, "Lafourche levee district"-----	9.83	
September, 1916, "Pontchartrain levee district"-----	.25	
November, 1916, "Surveys"-----	6.75	
November, 1916, "Atchafalaya levee district"-----	12.00	
November, 1916, "Lafourche levee district"-----	1.25	
November, 1916, "Pontchartrain levee district"-----	3.25	
Total miscellaneous receipts---	32,479.08	
Amount transferred in January, 1917, for construction of steel barge, third district allotment for "Ashbrook Diike," act of Mar. 4, 1915, credited to allotment for "Atchafalaya levee district," fourth district. (ED 71814-248)-----	21,075.90	
		\$11,403.18
Total-----		7,761,403.18

Expended.

Location and object.	To June 30, 1916.	During year ending June 30, 1917.	Total.
Mississippi River Commission.....	¹ \$61,960.33	\$7,790.96	\$69,751.29
Surveys, gauges, and observations.....	² 100,042.71	21,697.38	121,740.09
Levees, Head of Passes to Cape Girardeau, Mo.....	³ 2,265,112.07	842,195.41	3,107,307.48
Revetment and contraction works, permanent channel im- provement and protection.....	⁴ 568,594.87	588,634.84	2,157,229.71
Dredges and dredging.....	⁵ 383,960.74	221,701.41	605,662.15
Plant and miscellaneous.....	⁶ 503,244.25	52,865.32	556,109.57
Improving harbors and tributaries, except Vicksburg Harbor.	⁷ 236,382.12	85,289.77	321,671.89
Experimental revetment.....	32,318.89	351.84	32,670.73
Total expended.....	5,151,615.98	1,820,526.93	6,972,142.91
Balance unexpended June 30, 1917.....			789,260.27
Total appropriated, etc.....			7,761,403.18

¹ The amount, \$61,961.73, reported in annual report for 1916, has been decreased \$1.40, by refundments of overpayments by the secretary, as follows:

August, 1916, on voucher 9, December, 1915, \$0.40; October, 1916, on voucher 63, March, 1916, \$0.40, and on voucher 64, March, 1916, \$0.25 (to Mississippi River Commission).

² The amount, \$100,045.61, reported in annual report for 1916, has been decreased \$2.90, by refundments of overpayments by the secretary, as follows:

October, 1916, on vouchers 119, 188, 189, 190, and 191, in January, 1916, \$0.15, \$0.35, \$0.35, \$0.20, and \$0.20, respectively; October, 1916, on vouchers 24, 25, 28, 54, 94, and 96 in March, 1916, \$0.10, \$0.10, \$0.30, \$0.25, \$0.10, and \$0.10, respectively; February, 1917, on vouchers 60, 61, and 62 in March, 1916, \$0.15 each, respectively; on voucher 31 in April, 1916, \$0.25 (to surveys, gages, and observations).

³ The amount, \$2,266,225.25, reported in annual report for 1916, has been decreased \$1,113.18, by refundments of overpayments and reimbursements, as follows:

By the first and second districts officer—

August, 1916, vouchers 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to Lower Yazoo levee district).....	\$1.00
August, 1916, voucher 72, May, 1916 (to Lower St. Francis levee district).....	.20
July, 1916, voucher 27, March, 1916 (to White River levee district).....	.45

By the fourth district officer—

September, 1916, reimbursement from Fifth Louisiana levee district for cutting drainage ditch (E. D. 100210-225) (to Lower Tensas levee district).....	1,109.20
August, 1916, voucher 47, January, 1916 (to Barataria levee district).....	2.33

⁴ The amount, \$1,569,838.25, reported in annual report for 1916, has been decreased \$1,243.38, by refundments of overpayments and transfer, as follows:

By the first and second districts officer—

August, 1916, vouchers 99 and 100, May, 1916 (to Delta, Miss.).....	\$0.40
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By the third district officer—

August, 1916, \$2.68, vouchers 14, 138, and 140 in January, 1916, and voucher 164 in May, 1916—	
To Panther Forest, Ark.....	.20
To Greenville, Miss.....	1.00
To Grand Lake, Ark.....	1.48

By transfer in January, 1917, for construction of steel barge, third district allotment for "Ashbrook Dike," act of Mar. 4, 1915, credited to allotment for Atchafalaya levee district, fourth district (E. D. 71814-248).....

	1,240.30
--	----------

⁵ The amount, \$383,961.39, reported in annual report for 1916, has been decreased \$0.65 by refundments of overpayments by the secretary, as follows:

October, 1916, voucher 66, January, 1916, \$0.10, February, 1916, voucher 66, January, 1916, \$0.15, February, 1916, voucher 208, April, 1916, \$0.25, October, 1916, voucher 65, March, 1916, \$0.15 (to dredges and dredging).

⁶ The amount, \$503,244.99, reported in annual report for 1916, has been decreased \$0.74, by refundments of overpayments, as follows:

By the first and second districts officer—

August, 1916, voucher 100, January, 1916 (to plant).....	\$0.24
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By the third district officer—

August, 1916, voucher 14, 138, and 140, January, 1916, and voucher 164, May, 1916 (to plant).....	.50
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.74

⁷ The amount, \$236,521.75, reported in annual report for 1916, has been decreased \$139.63 by the fourth district officer, reimbursement from appropriation for maintenance and improvement of existing river and harbor works, allotment for South Pass Channel, Mississippi River (E. D. 30157-275).

APPROPRIATION FOR GAGING WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.

Allotments from general appropriations for examinations, surveys,

and contingencies of rivers and harbors by acts of—

Mar. 3, 1871 (allotment Apr. 11, 1871).....	\$5,000.00
June 10, 1872 (allotment July 11, 1872).....	5,000.00
Mar. 3, 1873 (allotment May 17, 1873).....	5,000.00
June 23, 1874 (allotment July 29, 1874).....	5,000.00
Mar. 3, 1875 (allotment Mar. 22, 1875).....	5,000.00

Specific appropriations by river and harbor acts of—

Aug. 14, 1876.....	5,000.00
June 18, 1878.....	5,000.00
Mar. 3, 1879.....	5,000.00

Specific appropriations by river and harbor acts of—Continued.

June 14, 1880.....	\$5,000.00
Mar. 3, 1881.....	5,000.00
Aug. 2, 1882.....	5,000.00
Deficiency act of Mar. 12, 1884.....	2,100.00
Specific appropriations by river and harbors acts of—	
July 5, 1884.....	5,000.00
Aug. 5, 1886.....	5,000.00
Allotted from specific appropriation by river and harbor act of Aug. 11, 1888 (allotment Oct. 17, 1888).....	
Deficiency act of Oct. 19, 1888.....	8,700.00
Allotments from permanent indefinite appropriation made by section 6 of river and harbor act of Aug. 11, 1888, for fiscal years, viz:	
1890 (allotment Aug. 23, 1889).....	9,000.00
1891 (allotment Aug. 19, 1890, \$8,700.00, less \$3,518.34 withheld in United States Treasury under ruling that only \$6,000.00 can be expended each fiscal year).....	5,181.66
1892 (allotment July 17, 1891).....	5,100.00
1893 (allotment July 15, 1892).....	5,500.00
1894 (allotment July 18, 1893).....	5,500.00
1895 (allotment June 5, 1894).....	5,500.00
1896 (allotment June 4, 1895).....	5,500.00
1897 (allotment May 13, 1896).....	5,500.00
1898 (allotment June 16, 1897).....	5,500.00
1899 (allotments May 27, 1898, \$5,500.00, July 12, 1898, \$500.00).....	6,000.00
1900 (allotment June 1, 1899).....	5,500.00
1901 (allotment July 2, 1900).....	6,000.00
1902 (allotment July 31, 1901).....	6,000.00
Allotments from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902, for fiscal years, viz:	
1903 (allotment July 23, 1902, \$9,600.00, less \$500.00 allotted Aug. 2, 1902, to St. Paul, Minn., district).....	9,100.00
1904 (allotment Apr. 18, 1903).....	9,100.00
1905 (allotment Aug. 11, 1904).....	9,100.00
1906 (allotment June 30, 1905).....	9,100.00
1907 (allotment July 2, 1906).....	9,100.00
1908 (allotment July 24, 1907).....	9,100.00
1909 (allotment July 3, 1908).....	9,100.00
1910 (allotment July 13, 1909).....	9,100.00
1911 (allotment July 27, 1910).....	9,600.00
1912 (allotment Feb. 7, 1911).....	9,100.00
1913 (allotment May 29, 1912).....	9,100.00
1914.....	9,100.00
1915 (allotment Sept. 2, 1914).....	9,100.00
1916 (allotment July 28, 1915).....	9,100.00
1917 (allotment Aug. 3, 1916).....	9,100.00

Total..... 292,181.66

Expended.

	To June 30, 1916.	During year ending June 30, 1917.	Total.
Expenditures.....	¹ \$263,997.11	\$8,313.92	\$272,312.08
Unexpended balances reverted to Treasury.....	17,452.85	646.09	18,097.89
Total.....	281,449.96	8,960.01	290,409.97
Unexpended balance June 30, 1917.....			1,771.69
Total appropriated, etc.....			292,181.66

¹ The amount, \$263,998.16, reported in annual report for 1916, has been decreased \$1.05, by refundments of overpayments, by the secretary, as follows:

October, 1916, voucher 124, March, 1916 (reverted to Treasury)..... \$0.40
 February, 1916, voucher 32, April, 1916 (reverted to Treasury)..... .65

3434 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1917.

APPROPRIATION FOR FLOOD CONTROL, MISSISSIPPI RIVER, AND SACRAMENTO RIVER,
CAL., 1918.

Allotment, June 20, 1917, from appropriation by sundry civil act
of June 12, 1917----- \$5,660,000.00
Balance unexpended June 30, 1917----- 5,660,000.00

APPROPRIATION FOR REBUILDING LEVEES OF THE MISSISSIPPI RIVER AND TRIBUTARIES
DAMAGED BY FLOODS.

Joint resolution of April 30, 1912----- \$1,500,000.00
Allotments:

Surveys, Ohio and Mississippi Rivers (allotment May 8, 1912)-----	\$1,000.00
Cairo drainage district (allotment May 21, 1912)-----	45,000.00
Upper St. Francis levee district (allotments May 21, 1912, \$65,000, and June 18, 1912, \$15,000)-----	80,000.00
Reelfoot levee district (allotment May 21, 1912)-----	60,000.00
Lower St. Francis levee district (allotments May 21, 1912, \$200,000, June 18, 1912, \$60,000)-----	260,000.00
White River levee district (allotment May 21, 1912)-----	175,000.00
Lower Yazoo levee district (allotment May 21, 1912)-----	173,000.00
Upper Tensas levee district (allotment May 21, 1912)-----	269,000.00
Red River levees (allotment May 21, 1912)-----	10,000.00
Atchafalaya levee district (allotment May 21, 1912)-----	150,000.00
Lafourche levee district (allotment May 21, 1912)-----	100,000.00
Lake Borgne levee district (allotment May 21, 1912)-----	10,000.00
East bank Mississippi River from Vicksburg to Bayou Sara, previously reported as allotments to Gum Ridge drainage district, Miss., Fort Adams to Tunica, La., and Bayou Sara La. (approved May 21, 1912)-----	50,000.00
Lower Tensas levee district, Palmyra (allotment June 18, 1912)-----	11,000.00
Lower Tensas levee district, Bougere (allotment June 18, 1912)-----	9,000.00
Bayou des Glaisses, Atchafalaya, Red River etc., (allotment June 18, 1912)-----	30,000.00
Lower Yazoo levee district (allotment July 22, 1912)-----	37,000.00
Upper Tensas levee district (allotment July 22, 1912)-----	30,000.00
	1,500,000.00

Miscellaneous receipts, previously reported----- 1,169.66

1,501,169.66

Expended.

	To June 30, 1916.	During year ending June 30, 1917.	Total.
Expenditures-----	\$1,445,114.49	-----	\$1,445,114.49
Unexpended balance, carried to surplus fund June 30, 1914-----	-----	-----	56,055.17
Total appropriated, etc-----	-----	-----	1,501,169.66

Appropriation for improving Yazoo River and tributaries, Miss.¹

Act of July 13, 1892	\$75,000.00
Act of Aug. 18, 1894	225,000.00
Act of Aug. 18, 1894	40,000.00
Act of June 4, 1897	350,000.00
Act of Mar. 3, 1901	510,000.00
Act of Mar. 3, 1909 (allotment Mar. 29, 1909)	44,000.00
Act of June 25, 1910	4,000.00
Act of July 25, 1912	5,000.00
Act of Mar. 4, 1913	10,000.00
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	1,263,000.00
Miscellaneous receipts, previously reported	.30
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Total	1,263,000.30

Expended.

	To June 30, 1916.	During year ending June 30, 1917.	Total.
Expenditures	\$1,248,277.78		\$1,248,277.78
Unexpended balance			14,722.52
Total appropriated, etc.			1,263,000.30

¹ Funds under this appropriation were transferred to the control of the district engineer officer, Vicksburg (Miss.) district, Oct. 9, 1916, under provision of river and harbor act July 27, 1916. (E.D. 7716-38.)

APPROPRIATION FOR MAINTAINING AND PROTECTING LEVEES OF MISSISSIPPI RIVER
AND TRIBUTARIES AGAINST FLOODS.

Act of April 3, 1912	\$350,000.00
Act of April 16, 1912	300,000.00
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Total specific appropriations	650,000.00
Miscellaneous receipts previously reported	490.80
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Total	650,490.80
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Expended to June 30, 1914	454,124.11
Amount carried to surplus fund June 30, 1913	195,850.59
Unexpended balance carried to surplus fund June 30, 1914	516.10
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Total	650,490.80

APPROPRIATION FOR EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND
HARBORS.

Allotments from appropriation by river and harbor act of March 3, 1905, for Ashport, Tenn. (allotments Mar. 29, 1905, \$25, and May 8, 1905, \$460)	\$485.00
Allotment from appropriation by river and harbor act of March 4, 1913, for canal leading from Centennial Lake at Vicksburg, Miss., to the Mississippi River	2,000.00
	<hr/>
	2,485.00
Expended during fiscal year 1906	\$485.00
Expended during fiscal year 1914	2,000.00
	<hr/>
	2,485.00

¹ Funds under this appropriation were transferred to the control of the district engineer officer, Vicksburg (Miss.) district, Oct. 9, 1916, under provision of river and harbor act July 27, 1916. (E.D. 7716-38.)

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APPROPRIATION FOR REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION—INDEFINITE.

Allotment for removing wreck of barkentine <i>Rachel Emery</i> -----	\$1,500.00
Expended in fiscal year 1913-----	1,500.00
<hr/>	
Allotment for removing wreck of bark <i>Santos Amarol</i> -----	8,000.00
June 30, 1916, expended in fiscal year-----	\$6.11
Expended during fiscal year 1917-----	7,993.89
	<hr/>
	8,000.00

APPROPRIATION FOR REPAIRING GOVERNMENT LEVEE AT WALNUT BEND, ARK.¹

Act of June 13, 1902 (river and harbor)-----	\$90,000.00
Expended to June 30, 1906-----	90,000.00

APPROPRIATION FOR WATERWAY FROM LOCKPORT, ILL., TO ST. LOUIS, MO.

Act of June 13, 1902 (river and harbor)-----	\$25,000.00
Amount transferred from allotment for "Survey of Illinois and Des Plaines Rivers, Ill.," as reimbursement-----	1,093.40
Total-----	26,093.40
Expended to June 30, 1906-----	\$22,291.23
Unexpended balance carried to surplus fund on June 30, 1909, under the provisions of section 10 of sundry civil act of March 4, 1909-----	3,802.17
	<hr/>
	26,093.40

APPROPRIATIONS FOR EMERGENCIES IN RIVER AND HARBOR WORKS.

Allotments from appropriation by act of April 28, 1904:	
For Wolf River (allotment July 6, 1904)-----	\$8,000.00
For Giles Bend, Miss. (allotment July 6, 1904)-----	40,000.00
	<hr/>
	48,000.00
Expended in fiscal year 1905-----	48,000.00
<hr/>	
Allotments from appropriation by act of March 3, 1905:	
For Old River (allotments Oct. 5, 1908, \$6,000, and Nov. 12, 1908, \$4,000)-----	10,000.00
Expended in fiscal year 1909-----	10,000.00

APPROPRIATION FOR CLAIMS FOR DAMAGES BY COLLISION, RIVER AND HARBOR WORKS.

Act of April 6, 1914 (urgent deficiency)-----	\$73.84
Expended in fiscal year 1914-----	73.84
<hr/>	
Act of September 8, 1916 (general deficiency)-----	475.28
Expended in fiscal year 1917-----	475.28

¹ Prior to June 30, 1906, was reported under appropriation for "improving Mississippi River."

CONTRIBUTED FUNDS.

For improvement of Mississippi River at Trotters Point, Miss-----	\$100,000.00	
June 30, 1914, expended in fiscal year-----	100,000.00	
		=====
For improvement of Mississippi River near Memphis, Tenn-----	\$1,800.00	
June 30, 1914, expended in fiscal year-----	\$1,066.61	
Unexpended balance refunded to contributor-----	733.39	
		=====
	1,800.00	
		=====
For improvement of Mississippi River at Avondale, La-----	45,000.00	
June 30, 1914, expended in fiscal year-----	\$32,467.28	
Unexpended balance refunded to contributor-----	12,532.72	
		=====
	45,000.00	
		=====
For improvement of Mississippi River at Torras, La-----	3,000.00	
June 30, 1914, expended in fiscal year-----	\$2,453.74	
Unexpended balance refunded to contributor-----	546.26	
		=====
	3,000.00	
		=====
For improvement of Mississippi River at Star Landing Bend, Miss--	210,000.00	
June 30, 1914, expended in fiscal year-----	\$35,009.30	
June 30, 1915, expended in fiscal year-----	174,990.70	
		=====
	210,000.00	
		=====
For improvement of Mississippi River near Laconia Circle, Ark---	8,000.00	
June 30, 1915, expended in fiscal year-----	8,000.00	
		=====
For improvement of Mississippi River at Delta, Miss-----	160,000.00	
June 30, 1915, expended in fiscal year-----	\$24,871.79	
June 30, 1916, expended in fiscal year-----	135,128.21	
		=====
	160,000.00	
		=====
For improvement of Mississippi River in Upper St.		
Francis levee district-----	¹ 234,000.00	
June 30, 1917, expended in fiscal year-----	\$26,734.69	
July 1, 1917, amount covered by existing contracts---	207,265.31	
		=====
	234,000.00	
		=====
For improvement of Mississippi River at Gayoso Bend, Mo-----	150,000.00	
June 30, 1917, expended in fiscal year-----	150,000.00	
		=====
For improvement of Mississippi River in the Reelfoot levee dis-		
trict (Kentucky)-----	25,000.00	
June 30, 1917, expended in fiscal year-----	25,000.00	

¹The amount, \$200,000, reported in annual report for 1916, has been increased by additional deposits of \$34,000.

Recapitulation of appropriations, expenditures, etc., under direction of the Mississippi River Commission to June 30, 1917.

Appropriation for—	Expended to June 30, 1917.	Carried to surplus fund, reverted balances returned to contributors, transferred to other districts and unallotted.	Balance unexpended June 30, 1917.	Total appropriated, etc.
Improving Mississippi River.....	\$79,895,370.76	¹ \$7,598.06	\$3,518,003.72	\$83,420,972.54
Maintenance and improvement of existing river and harbor works.....	6,972,142.91		789,260.27	7,761,403.18
Flood control, Mississippi River, and Sacramento River, Cal., 1918.....		² 5,660,000.00		5,660,000.00
Gauging waters of the Mississippi River and its tributaries ³	⁴ 132,498.59	⁵ 11,158.09	1,771.69	145,428.37
Rebuilding levees of the Mississippi River and its tributaries damaged by floods.....	1,445,114.49	¹ 56,055.17		1,501,169.66
Improving Yazoo River and tributaries, Miss.	⁶ 4,442.29	⁷ 14,722.52		19,164.81
Maintaining and protecting levees of Mississippi River and tributaries against floods.....	454,124.11	¹ 196,366.69		650,490.80
Examinations, surveys, and contingencies of rivers and harbors.....	2,485.00			2,485.00
Removing sunken vessels or craft obstructing or endangering navigation, indefinite.....	9,500.00			9,500.00
Repairing Government levee at Walnut Bend, Ark.....	90,000.00			90,000.00
Waterway from Lockport, Ill., to St. Louis, Mo.	22,291.23	¹ 3,802.17		26,093.40
Emergencies in river and harbor works.....	58,000.00			58,000.00
Claims for damages by collision, river and harbor works.....	549.12			549.12
Contributed funds.....	715,722.32	⁸ 13,812.37	207,265.31	936,800.00
Total.....	89,802,240.82	5,963,515.07	4,516,300.99	100,282,056.88

¹ Carried to surplus fund.¹

² Unallotted.

³ Since Feb. 11, 1901.

⁴ The amount \$124,185.72, reported in annual report for 1916, reduced \$1.05 by refundments of overpayments by the secretary, as follows:

October, 1916, voucher 124, March, 1916..... \$0.40

February, 1916, voucher 32, April, 1916..... .65

1.05

⁵ Unexpended balance reverted to Treasury.

⁶ Since Mar. 4, 1913.

⁷ Transferred to control of district engineer officer, Vicksburg, Miss., district, Oct. 9, 1916, under provision of river and harbor act July 27, 1916. (ED 7716-38.)

⁸ Returned to contributors.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917.

SECRETARY, MISSISSIPPI RIVER COMMISSION.

[Appropriations: Mississippi River; maintenance and improvement of existing river and harbor works; gauging waters of the Mississippi River and its tributaries; waterway from Lockport, Ill., to St. Louis, Mo.; for claims for damages by collision, river and harbor works.]

Appropriations.	Appropriation for Mississippi River, allotment for—				
	Mississippi River Commission.	Surveys, gauges, and observations.	Dredges and dredging.	Examination from Cape Girardeau, Mo., to Rock Island, Ill.	Levees, Rock Island to New Boston, Ill.
Amount expended on previous projects.....	\$238,110.74	\$855,247.37	.....	.....	.....
Amount expended on present project to end of last fiscal year.....	808,761.52	1,697,991.16	\$6,389,076.60	\$8,621.54	.....
Balance unexpended at end of last fiscal year.	1,522.78	3,598.38	22,481.81	1,378.46	.....
Amount appropriated or allotted since (net).	50,014.02	60,000.00	271,000.50	.....	\$15,000.00
	51,536.80	63,598.38	293,482.31	1,378.46	15,000.00
Amount expended from beginning of present fiscal year to end of previous month..	¹ 28,877.97	² 42,128.78	³ 93,623.25	1,373.76	275.12
Amount expended during the month.....	6,001.24	6,205.16	⁴ 16,666.84	4.70	.....
	34,879.21	48,333.94	⁵ 110,290.09	1,378.46	275.12
Balance unexpended at end of month.	16,657.59	15,264.44	183,192.22	.....	14,724.88
In Treasury United States.....	16,657.59	15,264.44	183,192.22	.....	14,724.88
Outstanding liabilities at end of month....	3,078.20	2,509.10	29,806.99	.....	.....
Amount covered by existing contracts at end of month.....	7.40	7,947.80	89,035.02	.....	.....
	3,085.60	10,256.90	118,842.01	.....	.....
Balance available at end of month...	13,571.99	5,007.54	⁶ 64,350.21	.....	14,724.88

¹ Amount, \$28,882.52, previously reported, reduced \$4.55, refundment of overpayment on voucher No. 24, November, 1916.

² Amount, \$42,106.28, previously reported, reduced \$67.50 by reimbursement from office of first and second Mississippi River districts for coal furnished by secretary's office. (Sec. MRC. 369-329 and 330.)

³ Amount, \$98,524.24, previously reported, reduced \$4,900.99 by following reimbursements: \$55 from St. Louis district office for coal furnished by secretary's office, and \$4,845.99 by first and second Mississippi River districts office for coal furnished by secretary's office. (ED 104197-596, Sec. MRC. 1256-77; Sec. 369-329 and 330.)

⁴ Includes transfers of \$316.70 (\$121.40 and \$195.30) on books of office, Chief of Engineers, under date of June 21, 1917, to allotment for "Plant" third Mississippi River district, for coal furnished the secretary's office. (ED 24722-29 and 31, Sec. MRC. 2228-10 and 12.)

⁵ Includes \$1,191.28 reimbursable, as follows: \$740, from appropriation for Army Transportation, fiscal year 1916-17; \$451.28 from St. Louis district office.

⁶ Does not include \$1,191.28 reimbursable, as follows: \$740, from appropriation for Army transportation, fiscal year 1916-17; \$451.28 from St. Louis district office.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

Appropriations.	Appropriation for Mississippi River, allotment for—Cor				
	Levees, Muscatine to mouth of Iowa River, Iowa.	Levees, Oquawka to Dallas, Ill.	Levees, Warsaw to Quincy, Ill.	Levees, La Grange to mouth of Missouri River, Mo.	Levees, Quincy to Hamburg Bay, Ill.
Amount expended on present project to end of last fiscal year.....			\$14,702.06	\$37,753.81	\$24,370.
Balance unexpended at end of last fiscal year...			5,297.94	2,146.28	35,629.
Amount appropriated or allotted since (net).....	\$30,000.00	\$20,000.00	30,000.00	20,000.00	70,000.
	30,000.00	20,000.00	35,297.94	22,146.28	105,629.
Amount expended from beginning of present fiscal year to end of previous month.....	360.90	645.36	3,444.38	335.05	400.
Amount expended during the month.....	12.28	46.53	4.34	1,392.92	5.
	373.18	691.89	3,448.72	1,727.97	405.
Balance unexpended at end of month.....	29,626.82	19,308.11	31,849.22	20,418.31	105,223.
In Treasury United States.....	29,626.82	19,308.11	31,849.22	20,418.31	105,223.
Outstanding liabilities at end of month.....	26.18	25.99	16.34	197.41	8.
Amount covered by existing contracts at end of month.....			6,392.31	16,338.42	4,422.
	26.18	25.99	6,408.65	16,535.83	4,430.
Balance available at end of month.....	29,600.64	19,282.12	25,440.57	3,882.48	100,792.

Appropriations.	Appropriation for Mississippi River, allotment for—Continued.			
	Levees, head of Chouteau Island to Prairie du Pont, Ill.	Levees, Grand Tower to Gale near Thebes, Ill.	Expended allotments.	Total.
Amount expended on previous projects.....				\$1,093,358.
Amount expended on present project to end of last fiscal year.....	\$60,000.00		\$71,231.05	9,112,508.
Balance unexpended at end of last fiscal year.....				72,054.
Amount appropriated or allotted since (net).....	25,000.00	\$20,000.00		611,014.
	25,000.00	20,000.00		683,069.
Amount expended from beginning of present fiscal year to end of previous month.....	459.29	2,020.14		173,944.
Amount expended during the month.....	218.83	2,143.16		32,701.
	678.12	4,163.30		206,645.
Balance unexpended at end of month.....	24,321.88	15,836.70		476,423.
In Treasury United States.....	24,321.88	15,836.70		476,423.
Outstanding liabilities at end of month.....	15.00	152.00		35,635.
Amount covered by existing contracts at end of month.....	14,100.00	12,154.68		150,397.
	14,115.00	12,306.68		186,033.
Balance available at end of month.....	10,206.88	3,530.02		290,390.

¹ Experimental dikes, \$45,075.58; patrol of the Mississippi River, \$1,055.56; spillway surveys, \$15,000; levees, Muscatine to Port Louisa, Iowa, \$99.91; levees, Grand Tower to near Thebes, Ill., \$10,000.

Consolidated statement of condition of of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

Appropriations.	Appropriation for maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for—			
	Mississippi River Commission.	Surveys, gages, and observations.	Dredges and dredging.	Total.
Amount expended on present project to end of last fiscal year.....	\$29,991.18	\$59,896.54	\$298,360.63	\$388,248.35
Balance unexpended at end of last fiscal year.....	8.82	103.46	1,639.37	1,751.65
Amount expended from beginning of present fiscal year to end of previous month.....		39.62	74.75	114.37
Balance unexpended at end of month.....	8.82	63.84	1,564.62	1,637.28
In Treasury United States.....	8.82	63.84	1,564.62	1,637.28
Balance available at end of month.....	8.82	63.84	1,564.62	1,637.28

Appropriations.	Appropriation for maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—			
	Mississippi River Commission.	Surveys, gages, and observations.	Dredges and dredging.	Total.
Amount expended on present project to end of last fiscal year.....	\$31,969.15	\$26,534.91	\$85,600.11	\$144,104.17
Balance unexpended at end of last fiscal year.....	8,030.85	33,465.09	314,399.89	355,895.83
Amount appropriated or allotted since (net).....		.79		.79
	8,030.85	33,465.88	314,399.89	355,896.62
Amount expended from beginning of present fiscal year to end of previous month.....	7,790.96	16,626.62	221,626.66	246,044.24
Balance unexpended at end of month.....	239.89	16,839.26	92,773.23	109,852.38
In Treasury United States.....	239.89	16,839.26	92,773.23	109,852.38
Balance available at end of month.....	239.89	16,839.26	92,773.23	109,852.38

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

Appropriations.	Appropriation for gaging waters of the Mississippi River and its tributaries.	Expended appropriations.	Appropriation for claims for damages by collision, river and harbor works (claim of West Kentucky Coal Co.).	Grand total.
Amount expended on previous projects.....				\$1,093,358.11
Amount expended on present project to end of last fiscal year.....	\$263,997.11	\$22,350.07		9,931,208.19
Balance unexpended at end of last fiscal year.....	² 986.66			430,689.04
Amount appropriated or allotted since (net).....	9,100.00		\$427.30	620,542.61
	10,086.66		427.30	1,051,231.65
Amount expended from beginning of present fiscal year to end of previous month.....	7,278.80		427.30	427,808.90
Amount expended during the month.....	³ 1,036.17			33,737.82
	8,314.97		427.30	461,546.72
Balance unexpended at end of month.....	1,771.69			589,684.93
In Treasury United States.....	1,771.69			589,684.93
Outstanding liabilities at end of month.....	906.59			36,542.20
Amount covered by existing contracts at end of month.....				150,397.66
	906.59			186,939.86
Balance available at end of month.....	865.10			402,745.07

¹ Waterway from Lockport, Ill., to St. Louis, Mo., \$22,291.23; unexpended balance, \$3,802.17, of this appropriation carried to surplus fund June 30, 1909, under provisions of sec. 10 of sundry civil act of Mar. 4, 1909 (E.D. 46863-142, sec. MRC 1125-9). Claims for damages by collision, river and harbor works, \$58.84.

² Of the unexpended balance for 1916, \$646.09 reverted to the Treasury.

³ Does not include \$4.50 overpayment on voucher 5 for June, refunded during the month.

WORKS ABOVE CAIRO.

[Appropriation: Improving Mississippi River.]

Appropriations.	Protection near Cairo. ¹	Pes Moines Rapids to Ohio River.	Total.
Amount expended on present project to end of last fiscal year..	\$50,000.00	\$687,632.53	\$737,632.53

¹ Includes only work under act of July 5, 1884.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FIRST AND SECOND DISTRICTS.

[Appropriations: Mississippi River: Maintenance and improvement of existing river and harbor works; repairing Government levee at Walnut Bend, Ark.; emergencies in river and harbor works; examinations, surveys, and contingencies of rivers and harbors; rebuilding levees of the Mississippi River and tributaries damaged by floods; maintaining and protecting levees of Mississippi River and tributaries against floods; for claims for damages by collision, river and harbor works.]

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for—					
	Upper St. Francis levee district.	Watson Point, Ky (dike at Slough Landing Neck).	Star Landing, Miss.	General repairs and stone.	Expended allotments.	Total.
Amount expended on present project to end of last fiscal year.....	\$98,514.80	\$112,526.86	\$84,874.71	\$49,389.99	\$316,028.86	\$1,161,335.22
Balance unexpended at end of last fiscal year.....	1,485.20	473.14	20,125.29	10,610.01	.....	32,693.64
Amount expended from beginning of present fiscal year to end of previous month.....	1,485.20	30.20	20,125.29	10,610.01	.....	32,250.70
Balance unexpended at end of month.....	.....	442.94	.....	.....	.....	442.94
In hand.....	.....	442.94	.....	.....	.....	442.94
Balance available at end of month.....	.....	442.94	.....	.....	.....	442.94

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—			
	Upper St. Francis levee district.	Lower St. Francis levee district.	White River levee district.	Slough Landing Neck, Tenn.
Amount expended on present project to end of last fiscal year.....	\$14,325.14	\$152,667.10	\$26,190.51	\$158,209.80
Balance unexpended at end of last fiscal year.....	50,674.86	162,333.55	133,809.49	41,790.20
Amount appropriated or allotted since (net).....	.....	.....	.45	.....
.....	50,674.86	162,333.55	133,809.94	41,790.20
Amount expended from beginning of present fiscal year to end of previous month.....	25,569.26	162,333.55	100,949.78	32,031.95
Amount expended during the month.....	2,095.09	.....	9,617.95	1,000.00
.....	27,664.35	162,333.55	110,567.73	33,031.95
Balance unexpended at end of month.....	23,010.51	.....	23,242.21	8,758.25
In Treasury United States.....	20,347.04	.....	8,001.08	5,028.84
In hand.....	2,663.47	.....	15,241.13	3,729.41
.....	23,010.51	.....	23,242.21	8,758.25
Outstanding liabilities at end of month.....	.....	.....	.....	200.00
Amount covered by existing contracts at end of month.....	23,010.51	.....	23,242.21	.....
.....	23,010.51	.....	23,242.21	200.00
Balance available at end of month.....	.....	.....	.....	8,558.25

¹ Surveys, \$1,500; Slough Landing Neck, Tenn., \$175,000; Lower St. Francis levee district, \$437,000; White River levee district, \$160,000; plant, \$40,028.86; experimental revetment, \$2,500.

² Distributed as follows: Star Landing, Miss., \$1,724.54; Trotters Point, Miss., \$2.23; Sunflower, Miss., 8.05; plant, \$8,875.19.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FIRST AND SECOND DISTRICTS—Continued.

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—			
	Plum Point reach.	Delta, Miss.	General repairs and stone.	Plant.
Amount expended on present project to end of last fiscal year.....	\$99,478.19	\$11,554.41	.....	\$66,059.21
Balance unexpended at end of last fiscal year.....	55,521.81	193,445.59	\$50,000.00	8,940.79
Amount expended from beginning of present fiscal year to end of previous month.....	55,521.81	81,033.46	43,032.14	8,927.32
Amount expended during the month.....	.....	2,002.25	6,967.86	13.47
	55,521.81	83,035.71	50,000.00	8,940.79
Balance unexpended at end of month.....	.....	10,409.88	.....	.....
In Treasury of United States.....	.....	9,000.00	.....	.....
In hand.....	.....	1,409.88	.....	.....
	.....	10,409.88	.....	.....
Outstanding liabilities at end of month.....	.....	200.00	.....	.....
Balance available at end of month.....	.....	10,209.88	.....	.....

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—				
	New plant.	Experimental revetment.	Memphis Harbor.	Expended allotments.	Total.
Amount expended on present project to end of last fiscal year.....	\$25,974.87	\$22,013.75	.....	\$3,000.00	\$579,472.98
Balance unexpended at end of last fiscal year.....	29,025.13	2,986.25	\$25,000.00	.....	653,527.67
Amount appropriated or allotted since (net).....	.....	.....	.....	.....	.45
	29,025.13	2,986.25	25,000.00	.....	653,528.12
Amount expended from beginning of present fiscal year to end of previous month.....	14,025.13	156.98	.....	.....	523,581.38
Amount expended during the month.....	.....	.....	.....	.....	21,696.62
	14,025.13	156.98	.....	.....	545,278.00
Balance unexpended at end of month.....	15,000.00	2,829.27	25,000.00	.....	108,250.12
In Treasury United States.....	.....	475.72	25,000.00	.....	67,852.68
In hand.....	15,000.00	2,353.55	.....	.....	40,397.44
	15,000.00	2,829.27	25,000.00	.....	108,250.12
Outstanding liabilities at end of month.....	15,000.00	2,829.27	6,500.00	.....	24,729.27
Amount covered by existing contracts at end of month.....	.....	.....	.....	.....	46,252.72
	15,000.00	2,829.27	6,500.00	.....	70,981.99
Balance available at end of month.....	.....	.....	18,500.00	.....	37,268.13

¹ Amount, \$118,445.59, reduced \$25,000, transfer to allotment for "Memphis Harbor," approved by Acting Secretary of War, June 11, 1917. (ED 15927-520.)

² Distributed as follows: Slough Landing Neck, Tenn., \$535.30; Barfield, Ark., \$1,545.98; Plum Point reach, \$26,041.39; Hopefield Bend (preservation of works at), \$7,296.03; Star Landing, Miss., \$8,855.62; Sunflower, Miss., \$172.50; plant, \$9,979.81; stone, \$1,573.37.

³ Surveys, \$3,000.

⁴ Transferred from allotment for "Delta, Miss.," approved by Acting Secretary of War June 11, 1917.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FIRST AND SECOND DISTRICTS—Continued.

Appropriations.	Mississippi River, allotment for—				
	Surveys.	Upper St. Francis levee district.	Lower St. Francis levee district.	White River levee district.	Reelfoot levee district.
Amount expended on present project to end of last fiscal year.....	\$157,881.71	\$820,300.00	\$2,943,189.05	\$2,534,645.80	\$345,000.00
Amount appropriated or allotted since (net).....	5,004.32	100,000.00	270,000.00	100,000.00	40,000.00
Amount expended from beginning of present fiscal year to end of previous month.....	4,535.06		11,420.52		
Amount expended during the month.....	469.26		23,946.96		8,029.66
	5,004.32		35,367.48		8,029.66
Balance unexpended at end of month.....		100,000.00	234,632.52	100,000.00	31,970.34
In Treasury United States.....		100,000.00	210,000.00	100,000.00	17,000.00
In hand.....			24,632.52		14,970.34
		100,000.00	234,632.52	100,000.00	31,970.34
Outstanding liabilities at end of month.....		1,000.00	1,200.00	600.00	200.00
Amount covered by existing contracts at end of month.....		95,500.00	189,200.00	79,400.00	22,000.00
		96,500.00	190,400.00	80,000.00	22,200.00
Balance available at end of month.....		3,500.00	44,232.52	20,000.00	9,770.34

Appropriations.	Mississippi River, allotment for—				
	Gayoso Bend, Mo.	Barfield, Ark.	Bullerton Bar, Ark.	Wolf River.	Porter Lake, Ark.
Amount expended on present project to end of last fiscal year.....				\$9,807.21	\$329,928.59
Balance unexpended at end of last fiscal year.....				192.79	
Amount appropriated or allotted since (net).....	\$150,000.00	\$200,000.00	\$150,000.00		105,000.00
	150,000.00	200,000.00	150,000.00	192.79	105,000.00
Amount expended from beginning of present fiscal year to end of previous month.....	45,371.66	131,555.75	59,857.29	192.79	25,932.87
Amount expended during the month.....	11,406.90	18,174.28	5,385.39		8,520.79
	56,778.56	149,730.03	65,242.68	192.79	34,453.66
Balance unexpended at end of month.....	93,221.44	50,269.97	84,757.32		70,546.34
In Treasury United States.....	81,000.00	39,366.60	79,000.00		59,500.00
In hand.....	12,221.44	10,903.37	5,757.32		11,046.34
	93,221.44	50,269.97	84,757.32		70,546.34
Outstanding liabilities at end of month.....	20,500.00	10,500.00	1,800.00		9,800.00
Amount covered by existing contracts at end of month.....	31,900.00	20,500.00	2,000.00		37,800.00
	52,400.00	31,000.00	3,800.00		47,600.00
Balance available at end of month.....	40,821.44	19,269.97	80,957.32		22,946.34

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FIRST AND SECOND DISTRICTS—Continued.

Appropriations.	Mississippi River, allotment for—				
	Helena, Ark.	Old Town Bend, Ark.	Memphis Harbor.	Repairs to existing works, and stone.	General repairs, and stone.
Amount expended on present project to end of last fiscal year.....	\$295,309.07	\$359,480.50	.....	(1)	.....
Balance unexpended at end of last fiscal year.....	31,320.75	.....	.....	.....	.....
Amount appropriated or allotted since (net).....	.....	105,000.00	\$26,000.00	.....	\$50,000.00
	31,320.75	105,000.00	26,000.00	.....	50,000.00
Amount expended from beginning of present fiscal year to end of previous month.....	1,150.33	58,720.24	12,047.97	.....	2,717.21
Amount expended during the month.....	.....	19,457.44	9,959.80	.....	1,311.21
	1,150.33	78,177.68	21,107.77	.....	24,028.50
Balance unexpended at end of month.....	30,170.42	26,822.32	4,892.23	.....	45,971.50
In Treasury United States.....	30,000.00	22,000.00	.....	.....	40,000.00
In hand.....	170.42	4,822.32	4,892.23	.....	5,971.50
	30,170.42	26,822.32	4,892.23	.....	45,971.50
Outstanding liabilities at end of month.....	.....	9,400.00	4,892.23	.....	2,100.00
Amount covered by existing contracts at end of month.....	.....	14,400.00	.....	.....	21,350.00
	.....	23,800.00	4,892.23	.....	23,450.00
Balance available at end of month..	30,170.42	3,022.32	.....	.....	22,521.50

¹ Total expenditures (\$210,000) under this allotment to end of fiscal year 1916 have been distributed to following works: Slough Landing Neck, \$31,376.96; Plum Point reach, \$11,375.71; Star Landing, Miss., \$16,611.69; Delta, Miss., \$965.24; plant (repairs), \$469.67; Hopefield Bend, \$7,853.26; improving harbor at Memphis, Tenn., \$1,340.91; Old Town Bend, Ark., \$2,689.33; Porter Lake, Ark., \$26,129.42; Helena, Ark., \$7,479.01; Golden Lake, Ark., \$12,323; Sunflower, Miss., \$14,423.25; stone, \$76,962.55.

² Distributed as follows: Star Landing, Miss., \$609.26; stone, \$3,419.24.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FIRST AND SECOND DISTRICTS—Continued.

Appropriations.	Mississippi River, allotment for—				Expended appropriations.
	Plant.	New plant.	Expended allotments.	Total.	
Amount expended on present project to end of last fiscal year.	\$1,839,759.65	\$617,345.38	\$11,447,812.30	\$21,700,459.26	\$823,058.97
Balance unexpended at end of last fiscal year		2,133.33		33,646.87	
Amount appropriated or allotted since (net)	75,380.50	297,000.00		1,673,384.82	
	75,380.50	299,133.33		1,707,031.69	
Amount expended from beginning of present fiscal year to end of previous month	44,635.77	113,077.47		511,214.99	
Amount expended during the month	4,400.54	4,263.95		114,426.20	
	49,036.31	117,341.42		625,641.19	
Balance unexpended at end of month	26,344.19	181,791.91		1,081,390.50	
In Treasury United States	17,000.00	167,000.00		961,866.60	
In hand	9,344.19	14,791.91		119,523.90	
	26,344.19	181,791.91		1,081,390.50	
Outstanding liabilities at end of month	5,600.00	46,000.00		113,592.23	
Amount covered by existing contracts at end of month				514,050.00	
	5,600.00	46,000.00		627,642.23	
Balance available at end of month	20,744.19	135,791.91		453,748.27	

¹ Upper Yazoo levee district, \$1,468,703.45; Walnut Bend levee, preservation of works at, \$28,200; preservation of works (levees), \$17,900; preservation of works (revetment and contraction works, permanent channel improvement and protection), \$36,958.89; Slough Landing Neck, Tenn., \$206,385.36; Chute of Island 26 (Abatis dikes), \$1,478.11; Plum Point reach, \$5,591,629.22; removal of Nonconnah rock, \$9,000; Golden Lake, Ark., \$91,193.91; Walnut Bend, Ark., \$346,309.92; Trotters Point, Miss., \$99,688.10; Sunflower, Miss., \$253,365.56; stone, \$134,803.80; dredges and dredging, \$388,097.12; experimental dikes, \$54,924.42; Columbus, Ky., \$43,750; at Hickman, Ky., \$95,132; at New Madrid, Mo., \$153,000; at Caruthersville, Mo., \$80,314.37; at Memphis, Tenn., \$45,000; improving harbor at Memphis, Tenn., \$1,429,244.94; improving harbor at Memphis, Tenn. (Wolf River), \$45,000; at Memphis, Tenn. (Wolf River), \$25,786; Hopefield Bend (preservation of works at), \$698,361.20; improving St. Francis River (Walnut Bend levee), \$75,000; survey, east bank Mississippi River, Bessie to Memphis, Tenn., \$11,000; Star Landing, Miss., \$16,611.69; Delta, Miss., \$965.24.

² Repairing Government levee at Walnut Bend, Ark., \$90,000; emergencies in river and harbor works (for Wolf River), \$8,000; examinations, surveys, and contingencies of rivers and harbors, \$485; rebuilding levees of the Mississippi River and tributaries damaged by floods, \$620,000; maintaining and protecting levees of Mississippi River and tributaries against floods, \$104,558.97; for claims for damages by collision river and harbor works, \$15.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FIRST AND SECOND DISTRICTS—Continued.

Appropriations.	Grand total.	Funds contributed for improvement of Mississippi River at Gayoso Bend, Mo. (special fund).	Funds contributed for improvement of Mississippi River in Upper St. Francis levee district (special fund).	Funds contributed for improvement of Mississippi River in the Reelfoot levee district (Kentucky special fund).	Expended contributed funds.
Amount expended on present project to end of last fiscal year	\$24,264,326.43	.....	.....	.....	\$479,066.61
Balance unexpended at end of last fiscal year	719,868.18	.....	\$200,000.00	.....	.....
Amount appropriated or allotted since (net)	1,673,385.27	\$150,000.00	34,000.00	\$25,000.00	.....
	2,393,253.45	150,000.00	234,000.00	25,000.00	.....
Amount expended from beginning of present fiscal year to end of previous month	1,067,047.07	150,000.00	18,056.18	22,188.97	.....
Amount expended during the month	136,122.82	.....	8,678.51	2,811.03	.....
	1,203,169.89	150,000.00	26,734.69	25,000.00	.....
Balance unexpended at end of month	1,190,083.56	.....	207,265.31	.....	.....
In Treasury United States	1,029,719.28	.....	200,000.00	.....	.....
In hand	160,364.28	.....	7,265.31	.....	.....
	1,190,083.56	.....	207,265.31	.....	.....
Outstanding liabilities at end of month	138,321.50	.....	.....	.....	.....
Amount covered by existing contracts at end of month	560,302.72	.....	207,265.31	.....	.....
	698,624.22	.....	207,265.31	.....	.....
Balance available at end of month	491,459.34	.....	.....	.....	.....

¹ For improvement of Mississippi River as follows: At Trotters Point, Miss., \$100,000; near Memphis, Tenn., \$1,066.61; near Laconia Circle, Ark., \$8,000; at Star Landing Bend, Miss., \$210,000; at Delta, Miss., \$160,000.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

THIRD DISTRICT.

[Appropriations: Mississippi River; maintenance and improvement of existing river and harbor works; maintaining and protecting levees of the Mississippi River and tributaries against floods; rebuilding levees of the Mississippi River and tributaries damaged by floods; improving Yazoo River and tributaries, Miss.; examinations, surveys and contingencies of rivers and harbors for claims for damages by collision, river and harbor works.]

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for—				
	Upper Tensas levee district.	Lower Yazoo levee district.	Repairs to existing works, and stone.	Expended allotments.	Total.
Amount expended on present project to end of last fiscal year.....	\$168,345.84	\$205,611.03	(1)	² \$302,227.95	\$676,184.82
Balance unexpended at end of last fiscal year.....	231,654.31	166,388.97	\$9,787.45		407,830.73
Amount expended from beginning of present fiscal year to end of previous month...	50,340.98	54,866.80	9,787.45		114,995.23
Amount expended during the month.....	1,294.88	³ 74.55			1,369.43
	51,635.86	54,941.35	⁴ 9,787.45		116,364.66
Balance unexpended at end of month.....	180,018.45	111,447.62			291,466.07
In Treasury United States.....	175,000.00	89,967.98			264,967.98
In hand.....	5,018.45	21,479.64			26,498.09
	180,018.45	111,447.62			291,466.07
Outstanding liabilities at end of month...	15,093.53				15,093.53
Amount covered by existing contracts at end of month.....		111,447.62			111,447.62
	15,093.53	111,447.62			126,541.15
Balance available at end of month...	164,924.92				164,924.92

¹ Amount (\$15,445.15) expended during fiscal year 1916, distributed to following works: Lake Bolivar Front, \$1,729.37; Panther Forest, Ark., \$29,903.02; Greenville, Miss., \$409.45; Fittlers Bend, \$7,301.43; Delta Point, La., \$26.45; Albemarle Bend, \$1.88; stone, \$6,073.55.

² Greenville, Miss., \$80,409.45; surveys, third district, \$2,000; Fittlers Bend, \$11,389.90; Delta Point, La., \$395.35; Reid-Bedford Bend, \$705.71; Ashbrook Neck, \$643.07; Panther Forest, Ark., \$43,998.49; Albemarle Bend, \$4,105.47; Lake Bolivar Front, \$6,664.62; Vaucluse, Ark., \$3,027.15; stone, third district, \$18,888.74; Grand Lake, Ark., \$80,000; plant, third district, \$50,000.

³ Includes \$32.02 in Treasury settlement No. 28357, for freight service.

⁴ Distributed as follows: Lake Bolivar Front, \$773.81; Panther Forest, Ark., \$626.01; Fittlers Bend, \$689.31; Greenville, Miss., \$1,255.15; Delta Point, La., \$1,035.82; Vaucluse, Ark., \$4,672.22; and stone, third district, \$735.13.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

THIRD DISTRICT—Continued.

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—				
	Surveys, third district.	Upper Tensas levee district.	Lower Yazoo levee district.	Lake Bolivar Front.	Ashbrook dike.
Amount expended on present project to end of last fiscal year.....	\$5,035.06	\$69,763.01	\$113,284.43	\$62,147.00	\$2,260.00
Balance unexpended at end of last fiscal year.....	4,964.94	125,236.99	71,716.57	7,853.00	86,664.00
Amount appropriated or allotted since (net).....		6,300.00	6,300.00		
	4,964.94	131,536.99	78,016.57	7,853.00	86,664.00
Amount expended from beginning of present fiscal year to end of previous month.....	2,281.20	94,934.43	69,358.28	7,853.00	86,664.00
Amount expended during the month.....	134.82	2,100.97	1,037.78		
	2,416.02	97,035.40	70,396.06	7,853.00	86,664.00
Balance unexpended at end of month.....	2,548.92	34,501.59	7,620.51		
In Treasury United States.....		21,300.00			
In hand.....	2,548.92	13,201.59	7,620.51		
	2,548.92	34,501.59	7,620.51		
Outstanding liabilities at end of month.....	487.45				
Amount covered by existing contracts at end of month.....		11,207.54	7,620.51		
	487.45	11,207.54	7,620.51		
Balance available at end of month.....	2,061.47	23,294.05			

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—				
	Ashbrook Neck.	Panther Forest, Ark.	Greenville, Miss.	Grand Lake, Ark.	Fittlers Bend.
Amount expended on present project to end of last fiscal year.....	\$37,058.26	\$77,019.59	\$70,472.53	\$56,311.60	\$9,051.20
Balance unexpended at end of last fiscal year.....	37,941.74	42,980.41	39,615.75	3,688.40	50,948.70
Amount expended from beginning of present fiscal year to end of previous month.....	6,753.59	42,980.41	39,615.75	3,688.40	50,948.70
Amount expended during the month.....	4,413.32				
	11,166.91	42,980.41	39,615.75	3,688.40	50,948.70
Balance unexpended at end of month.....	26,774.83				
In Treasury United States.....	30,000.00				
In hand.....	-3,225.17				
	26,774.83				
Outstanding liabilities at end of month.....	17,044.11				
Amount covered by existing contracts at end of month.....	8,327.89				
	25,372.00				
Balance available at end of month.....	1,402.83				

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

THIRD DISTRICT—Continued.

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—				Mississippi River, allotment for surveys, third district.
	Repairs to existing works, and stone.	Plant, third district.	Experimental revetment.	Total.	
Amount expended on present project to end of last fiscal year.....		\$170,410.50	\$7,805.14	\$680,618.46	\$151,456.53
Balance unexpended at end of last fiscal year.....	\$25,000.00	9,842.36	194.86	506,647.78	.....
Amount appropriated or allotted since (net).....		2,125.55	.....	14,725.55	5,000.00
	25,000.00	11,967.91	194.86	521,373.33	5,000.00
Amount expended from beginning of present fiscal year to end of previous month..	25,000.00	11,967.91	194.86	442,240.59	.....
Amount expended during the month.....				7,686.89	.....
	¹ 25,000.00	11,967.91	194.86	449,927.48	.....
Balance unexpended at end of month.....				71,445.85	5,000.00
In Treasury United States.....				51,300.00	5,000.00
In hand.....				20,145.85	.....
				71,445.85	5,000.00
Outstanding liabilities at end of month....				17,531.56	.....
Amount covered by existing contracts at end of month.....				27,155.94	.....
				44,687.50	.....
Balance available at end of month.....				26,758.35	5,000.00

¹ Distributed as follows: Grand Lake, Ark., \$38.20; Panther Forest, Ark., \$6.50; Fittlers Bend, \$15,740.55; Greenville, Miss., \$881.22; Vauclose, Ark., \$6,795.50; and stone, third district, \$1,538.03.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

THIRD DISTRICT—Continued.

Appropriations.	Mississippi River, allotment for—				
	Upper Tensas levee district.	Lower Yazoo levee district.	Lake Bolivar Front.	Ashbrook Neck.	Ashbrook dike.
Amount expended on present project to end of last fiscal year.....	\$6,899,895.74	\$5,579,715.81	\$365,249.60	\$802,769.70	.....
Amount appropriated or allotted since (net).....	384,000.75	349,000.00	30,000.00	40,000.00	\$212,000.
Amount expended from beginning of present fiscal year to end of previous month.....	49,531.77	233,384.50	25,902.55	.....	88,669.
Amount expended during the month..	31,019.93	10,995.48	235.00	1,654.38	9,003.
	80,551.70	244,379.98	26,137.55	1,654.38	97,673.
Balance unexpended at end of month.....	303,449.05	104,620.02	3,862.45	38,345.62	114,326.
In Treasury United States.....	333,966.41	113,997.12	1,418.76	38,345.62	120,102.
In hand.....	-30,517.36	-9,377.10	2,443.69	.....	-5,775.
	303,449.05	104,620.02	3,862.45	38,345.62	114,326.
Outstanding liabilities at end of month.	57,566.15	2,387.43	.....	.....	31,283.
Amount covered by existing contracts at end of month.....	206,851.72	21,073.94	.....	.....	.....
	264,417.87	23,461.37	.....	.....	31,283.
Balance available at end of month.....	39,031.18	81,158.65	3,862.45	38,345.62	83,043.

Appropriations.	Mississippi River, allotment for—				
	Panther Forest, Ark.	Fittlers Bend.	Cottonwood, Miss.	Improving harbor at Vicksburg, Miss.	Reid-Bedford Bend
Amount expended on present project to end of last fiscal year.....	\$266,734.53	\$380,833.51	.....	\$442,724.77	\$310,074.
Amount appropriated or allotted since (net).....	70,000.00	9,000.00	220,010.00	100,000.00	100,000.
Amount expended from beginning of present fiscal year to end of previous month.....	40,909.04	8,807.74	207,597.56	69,726.34	23,509.
Amount expended during the month..	2,467.02	.....	2 6,778.72	233.02	2,969.
	43,376.06	8,807.74	214,376.28	69,959.36	26,479.
Balance unexpended at end of month.....	26,623.94	192.26	5,633.72	30,040.64	73,520.
In Treasury United States.....	11,082.45	192.26	2,120.87	5,562.12	75,000.
In hand.....	15,541.49	.....	3,512.85	24,478.52	-1,479.
	26,623.94	192.26	5,633.72	30,040.64	73,520.
Outstanding liabilities at end of month.	4,380.53	.....	2,978.92	9,595.60	5,850.
Amount covered by existing contracts at end of month.....	.....	.....	.....	.....	26,000.
	4,380.53	.....	2,978.92	9,595.60	31,850.
Balance available at end of month.....	22,243.41	192.26	2,654.80	20,445.04	41,670.

¹ Part, Treasury settlement No. 28650, for freight service.² Includes \$2,032.65, part of Treasury settlement No. 28650, for freight service.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

THIRD DISTRICT—Continued.

Appropriations.	Mississippi River, allotment for—				
	Red Fork, Ark.	Repairs to existing works, and stone.	Plant, third district.	Expended allotments.	Total.
Amount expended on present project to end of last fiscal year.....			\$2,283,411.53	\$7,856,472.16	\$25,339,337.92
Amount appropriated or allotted since (net).....	\$80,000.00	² \$100,000.00	³ 286,127.12		1,985,137.87
Amount expended from beginning of present fiscal year to end of previous month.....	54,880.38	44,632.37	⁴ 188,110.91		1,035,662.06
Amount expended during the month.....	⁶ 13,096.55	⁶ 9,401.46	23,187.36		111,042.76
	67,976.93	⁷ 54,033.83	211,298.27		1,146,704.82
Balance unexpended at end of month.....	12,023.07	45,966.17	74,828.85		838,433.05
In Treasury United States.....	18,427.19	11,360.89	95,047.46		831,623.62
in hand.....	-6,404.12	34,605.28	-20,218.61		6,809.43
	12,023.07	45,966.17	74,828.85		838,433.05
Outstanding liabilities at end of month.....	12,023.07	13,897.32	62,542.26		202,505.42
Amount covered by existing contracts at end of month.....			24.00		253,949.66
	12,023.07	13,897.32	62,566.26		456,455.08
Balance available at end of month.....		32,068.85	12,262.59		381,977.97

¹ Longwood, Miss., \$157,010.28; Lake Providence Reach, \$3,936,957.46; stone, third district, \$503,949.18; Vauluse, Ark., \$153,517.17; Leland Neck, Ark., \$198,850.72; survey, east bank, Mississippi River, Brunswick to Warrenton, Miss., \$6,936.59; Beulah Crevasse, \$550,000; Arkansas River levees, \$50,000; Albemarle Bend, \$594,819.14; Grand Lake, Ark., \$159,456.47; Greenville, Miss., \$1,289,801.88; Delta Point, La., \$255,173.27.

² Amount, \$120,000, previously reported reduced \$20,090, by transfer to allotment for "Plant." Approved by Assistant Secretary of War, June 28, 1917. (ED 15927-525.)

³ Amount, \$266,037.12, previously reported, increased \$20,090, as follows: \$90.00 by sale of condemned barges, June 18, 1917, and \$20,000 by transfer from allotment for "Repairs to existing works and stone." (ED 15927-525.)

⁴ Amount, \$188,440.11, previously reported, reduced \$329.20, as follows: \$12.50 refundment of overpayment on voucher No. 139, May, 1917, and \$316.70 transferred from office of secretary, Mississippi River Commission, on books of office, Chief of Engineers, under date of June 21, 1917, for coal furnished the secretary's office. (ED 24722-29 and 31.)

⁵ Includes \$88.89 in Treasury settlements, as follows: No. 28488, for \$40.40; No. 28416, for \$22.86; and No. 28626, for \$25.63.

⁶ Includes \$3,698.31, part of Treasury settlement No. 28650, for freight service.

⁷ Distributed as follows: Filters Bend, \$45,379.07; Greenville, Miss., \$877.91; Vauluse, Ark., \$1,509.96; Albemarle Bend, Miss., \$7.35, and stone, third district, \$6,259.54.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

THIRD DISTRICT—Continued.

Appropriations.	Yazoo River and tributaries, Miss., Yazoo River, at mouth.	Appropriation for claims for damages by collision, river and harbor works (claim of Miller Engineering Co.).	Expended appropriations.	Grand total.
Amount expended on present project to end of last fiscal year.....	\$1,248,277.78		\$811,604.43	\$28,756,023.41
Balance unexpended at end of last fiscal year.....	14,722.52			929,201.03
Amount appropriated or allotted since (net).....		\$47.98		1,999,911.40
		47.98		2,929,112.43
Amount expended from beginning of present fiscal year to end of previous month.....		47.98		1,607,668.38
Amount expended during the month.....				120,099.08
		47.98		1,727,767.46
Balance unexpended at end of month.....				1,201,344.97
In Treasury United States.....				1,147,891.60
In hand.....				53,453.37
				1,201,341.97
Outstanding liabilities at end of month.....				235,130.51
Amount covered by existing contracts at end of month.....				392,553.22
				627,683.73
Balance available at end of month.....				573,661.24

¹ Maintaining and protecting levees of the Mississippi River and tributaries against floods (protection of levees, third district, \$170,618.52; protection of levees, Red River and tributaries, \$5,729.35), \$176,347.87; examinations, surveys, and contingencies of rivers and harbors (canal leading from Centennial Lake at Vicksburg, Miss., to the Mississippi River), \$2,000; rebuilding levees of the Mississippi River and tributaries damaged by floods (Lower Yazoo levee district, \$210,000; Upper Tensas levee district, \$415,000; Red River levees, \$8,256.50), \$633,256.56.

² Balance unexpended at end of last fiscal year, \$14,722.52, transferred Oct. 9, 1916, to district engineer officer, Vicksburg, Miss., district, under provision of river and harbor act of July 27, 1916. (ED 7716-38.)

FOURTH DISTRICT.

Appropriations: Mississippi River; maintenance and improvement of existing river and harbor works; emergencies in river and harbor works; maintaining and protecting levees of the Mississippi River and tributaries against floods; removing sunken vessels or craft obstructing or endangering navigation; rebuilding levees of the Mississippi River and tributaries damaged by floods.]

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for—				
	Lower Tensas levee district.	Achafalaya levee district.	Pontchartrain levee district.	Kempe Bend re-vestment.	Marengo Bend.
Amount expended on present project to end of last fiscal year.....	\$205,373.40	\$86,329.76	\$75,555.49	\$60,024.00	\$219.57
Balance unexpended at end of last fiscal year.....	69,626.60	38,670.24	24,444.51	228.96	4,780.43
Amount expended from beginning of present fiscal year to end of previous month.....	48,643.02	38,670.24	24,444.51	228.96	4,780.43
Balance unexpended at end of month.....	20,983.58				
In hand.....	20,983.58				
Balance available at end of month...	20,983.58				

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FOURTH DISTRICT—Continued.

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for—				
	Natchez front.	General repairs, and stone.	Expended allotments.	Total.	
Amount expended on present project to end of last fiscal year.....	\$11,113.54	(1)	² \$496,525.65	\$935,141.41	
Balance unexpended at end of last fiscal year.....	886.46			138,637.20	
Amount expended from beginning of present fiscal year to end of previous month.....	693.64			117,460.80	
Balance unexpended at end of month.....	192.82			21,176.40	
In hand.....	192.82			21,176.40	
Balance available at end of month.....	192.82			21,176.40	

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—					
	Surveys.	Lower Tensas levee district.	Atchafalaya levee district.	Lafourche levee district.	Barataria levee district.	Pontchartrain levee district.
Amount expended on present project to end of last fiscal year.....	\$2,076.20	\$87,827.25	\$24,430.42	\$10,198.54	\$46,633.87	\$6,152.82
Balance unexpended at end of last fiscal year.....	5,923.80	161,719.75	61,885.18	15,529.46	15,602.13	33,951.18
Amount appropriated or allotted since (net).....	19.25	260.00	12.00	11.08		13.50
	5,943.05	161,979.75	61,897.18	15,540.54	15,602.13	33,964.68
Amount expended from beginning of present fiscal year to end of previous month.....	2,615.12	48,097.30	25,037.98	15,540.54	15,602.13	33,097.76
Amount expended during the month.....	2,615.12	49,737.39	25,037.98	15,540.54	15,602.13	33,097.76
Balance unexpended at end of month.....	3,327.93	112,242.36	36,859.20			866.92
In Treasury United States.....	2,519.25	96,160.06	21,327.60			117.50
In hand.....	808.68	16,082.30	15,531.60			749.42
	3,327.93	112,242.36	36,859.20			866.92
Amount covered by existing contracts at end of month.....		112,242.36	33,997.17			
Balance available at end of month.....	3,327.93		2,862.03			866.92

¹ Amount, \$6,848.35, expended during the fiscal year 1916, distributed to following works: Harbor at New Orleans, La., \$4,529.13; Bondurant, \$2,319.22.

² Lafourche levee district, \$100,000; Barataria levee district, \$76,265; Lake Borgne levee district, \$75,000; Giles Bend, \$40,181.25; Plaquemine, La., \$50,000; plant, \$60,513.61; harbor at New Orleans, La., \$51,529.13; Atchafalaya and Red Rivers, La., \$15,000; Hard Times Bend, \$22,714.44; Bondurant, \$2,319.22.

3456 REPORT OF CHIEF OF ENGINEERS, U. S. ARMY, 1917.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FOURTH DISTRICT—Continued.

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—					
	Lake Borgne levee district.	Hard Times Bend.	Kempe Bend revetment.	Plaque-mine, La., revetment.	General repairs, and stone.	Plant.
Amount expended on present project to end of last fiscal year.....	\$25,643.66	\$96,934.39	\$785.41	\$26,525.33	(¹)	\$90,257.20
Balance unexpended at end of last fiscal year.....	15,362.34	29,065.61	19,214.59	3,474.67	\$19,805.29	15,552.80
Amount appropriated or allotted since (net).....						2,378.69
	15,362.34	29,065.61	19,214.59	3,474.67	19,805.29	17,931.49
Amount expended from beginning of present fiscal year to end of previous month.....	15,362.34	24,065.60	19,213.02	1,859.85	215,231.11	17,931.49
Balance unexpended at end of month.....		5,000.01	1.57	1,614.82	4,574.18	
In Treasury United States.....		4,459.46			98.06	
In hand.....		540.55	1.57	1,614.82	4,476.12	
Balance available at end of month.....		5,000.01	1.57	1,614.82	4,574.18	

Appropriations.	Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for—				
	Harbors at Natchez and Vidalia, Miss. and La.	Harbor at New Orleans, La.	Atchafalaya and Red Rivers, La.	Expended allotments.	Total.
Amount expended on present project to end of last fiscal year.....	\$130,620.00	\$23,433.80	\$12,799.19	\$2,192.49	\$586,510.57
Balance unexpended at end of last fiscal year.....	64,014.00	24,688.42	7,200.81		492,990.03
Amount appropriated or allotted since (net).....		2,391.36			5,085.88
	64,014.00	27,079.78	7,200.81		498,075.91
Amount expended from beginning of present fiscal year to end of previous month.....	64,014.00	6,744.69	7,033.66		311,446.59
Amount expended during the month.....	64,014.00	6,744.69	7,033.66		1,640.09
					313,086.68
Balance unexpended at end of month.....		20,335.09	167.15		184,989.23
In Treasury United States.....		15,331.77	167.15		140,180.85
In hand.....		5,003.32			44,808.38
		20,335.09	167.15		184,989.23
Amount covered by existing contracts at end of month.....					146,239.53
Balance available at end of month.....		20,335.09	167.15		38,749.70

¹ Amount, \$5,194.71, expended during the fiscal year 1916, distributed to following works: Harbor at New Orleans, La., \$3,002.22; Bondurant, \$2,192.49.

² Distributed as follows: Harbor at New Orleans, La., \$7,497.42; Marengo Bend, \$3,462.02; Giles Bend, \$1,271.67.

³ Bondurant, \$2,192.49.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FOURTH DISTRICT—Continued.

Appropriations.	Mississippi River, allotment for—				
	Surveys, gages, and observa- tions.	Lower Tensas Levee district.	Atchafalaya Levee district.	Lafourche Levee district.	Barataria Levee district.
Amount expended on present project to end of last fiscal year.....	\$150,165.52	\$4,738,205.68	\$2,003,434.50	\$880,769.14	\$675,163.95
Balance unexpended at end of last fiscal year.....			40,701.42		
Amount appropriated or allotted since (not).....	¹ 5,006.10	² 324,002.50	³ 150,001.25	100,000.00	95,000.00
	5,006.10	324,002.50	190,702.67	100,000.00	95,000.00
Amount expended from beginning of present fiscal year to end of previous month.....	515.27	35,193.62	40,015.63	15,965.43	26,149.74
Amount expended during the month..		3,519.62	8,427.09	4,179.10	706.71
	515.27	38,713.24	48,442.72	20,144.53	26,856.45
Balance unexpended at end of month.....	4,490.83	285,289.26	142,259.95	79,855.47	68,143.55
In Treasury United States.....	4,006.10	286,002.50	148,830.19	78,999.11	64,009.63
In hand.....	484.73	—713.24	—6,570.24	856.36	4,133.92
	4,490.83	285,289.26	142,259.95	79,855.47	68,143.55
Outstanding liabilities at end of month.	767.42	70,369.24	327.45	4,568.86	528.99
Amount covered by existing contracts at end of month.....		62,755.14	112,229.39	47,427.96	
	767.42	133,124.38	112,556.84	51,996.82	528.99
Balance available at end of month	3,723.41	152,164.88	29,703.11	27,858.65	67,614.56

¹ Amount, \$5,000, previously reported increased \$6.10, received from sale of blue prints.

² Amount, \$324,000, previously reported increased \$2.50, received from sale of blue prints.

³ Amount, \$150,000, previously reported increased \$1.25, received from sale of blue prints.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FOURTH DISTRICT—Continued.

Appropriations.	Mississippi River, allotment for—				
	Homo- chitto Levee district.	Pontchar- train Levee district.	Lake Borgne Levee district.	Hard Times Bend.	Bondu- rant.
Amount expended on present project to end of last fiscal year.....	\$2, 508. 89	\$2, 062, 594. 30	\$609, 561. 11	\$145, 000. 00	\$78, 500. 00
Balance unexpended at end of last fiscal year.....	493. 71				
Amount appropriated or allotted since (net).....		125, 000. 00	50, 000. 00	100, 000. 00	35, 000. 00
	493. 71	125, 000. 00	50, 000. 00	100, 000. 00	35, 000. 00
Amount expended from beginning of present fiscal year to end of previous month.....		22, 916. 03	10, 450. 39	28, 632. 99	11, 644. 96
Amount expended during the month..		6, 828. 08	2, 525. 75	644. 50	214. 88
		29, 744. 11	12, 976. 14	29, 277. 49	11, 859. 84
Balance unexpended at end of month.....	493. 71	95, 255. 89	37, 023. 86	70, 722. 51	23, 140. 16
In Treasury United States.....	2. 35	92, 000. 00	32, 007. 50	60, 000. 00	12, 000. 00
In hand.....	491. 36	3, 255. 89	5, 016. 36	10, 722. 51	11, 140. 16
	493. 71	95, 255. 89	37, 023. 86	70, 722. 51	23, 140. 16
Outstanding liabilities at end of month.....		3, 708. 13	2, 908. 89	4, 992. 72	3, 650. 52
Amount covered by existing contracts at end of month.....		60, 821. 00		39, 890. 03	
		64, 529. 13	2, 908. 89	44, 882. 75	3, 650. 52
Balance available at end of month	493. 71	30, 726. 76	34, 114. 97	25, 839. 76	19, 489. 64

Appropriations.	Mississippi River, allotment for—				
	Kempe Bend revetment.	Giles Bend.	Marengo Bend.	Grand Bay.	General repairs, and stone.
Amount expended on present project to end of last fiscal year.....	\$1, 295, 000. 00				\$45, 000. 00
Amount appropriated or allotted since (net).....	65, 000. 00	110, 000. 00	\$90, 000. 00	\$175, 000. 00	23, 000. 00
Amount expended from beginning of present fiscal year to end of previous month.....	35, 024. 65	38, 471. 01	54, 657. 53	141, 090. 75	9, 186. 94
Amount expended during the month..	135. 77	318. 79	131. 36	1, 474. 76	
	35, 160. 42	38, 789. 80	54, 788. 89	142, 565. 51	9, 186. 94
Balance unexpended at end of month.....	29, 839. 58	71, 210. 20	35, 211. 11	32, 434. 49	13, 813. 06
In Treasury United States.....	25, 000. 00	54, 997. 23	25, 000. 00	30, 000. 00	8, 000. 00
In hand.....	4, 839. 58	16, 212. 97	10, 211. 11	2, 434. 49	5, 813. 06
	29, 839. 58	71, 210. 20	35, 211. 11	32, 434. 49	13, 813. 06
Outstanding liabilities at end of month.....	3, 677. 97	4, 165. 66	2, 511. 84	432. 06	730. 62
Amount covered by existing contracts at end of month.....	1, 601. 42				
	5, 279. 39	4, 165. 66	2, 511. 84	432. 06	730. 62
Balance available at end of month	24, 560. 19	67, 044. 54	32, 699. 27	32, 002. 43	13, 082. 44

¹ Includes \$0.277 in Treasury Settlement No. 28487, May 23, 1917, for freight service in February, 1917.

² Distributed as follows: Harbor at New Orleans, La., \$3,186.94; Plaquemine, La., revetment, \$6,000.

*Consolidated statement of condition of appropriations and allotments under
Mississippi River Commission on June 30, 1917—Continued.*

FOURTH DISTRICT—Continued.

Appropriations.	Mississippi River, allotment for—				
	Plant.	Harbor at New Orleans, La.	Atcha- falaya and, Red Rivers La.	Expended general allotments.	Expended specific allotments.
Amount expended on present project to end of last fiscal year.	\$1, 193, 494. 82	\$1, 030, 951. 00	\$135, 453. 95	¹ \$1,938, 418. 42	² \$2, 268, 066. 65
Amount appropriated or allotted since (net).....	166, 029. 00	³ 133, 317. 28	15, 000. 00	.....	.....
Amount expended from beginning of present fiscal year to end of previous month.....	129, 143. 98	16, 453. 43	14, 898. 03	.....	.....
Amount expended during the month.....	16, 300. 88	4, 931. 37	45. 63	.....	.....
	⁴ 145, 444. 86	21, 384. 80	14, 943. 66	.....	.....
Balance unexpended at end of month.....	20, 584. 14	111, 932. 48	56. 34	.....	.....
In Treasury United States.....	18, 384. 76	110, 126. 86	.....	.....	.....
In hand.....	2, 199. 38	1, 805. 62	56. 34	.....	.....
	20, 584. 14	111, 932. 48	56. 34	.....	.....
Outstanding liabilities at end of month.....	19, 207. 22	8, 724. 74	10. 25	.....	.....
Balance available at end of month.....	⁵ 1, 376. 92	103, 207. 74	46. 09	.....	.....

¹ Preservation of works, \$134,000; Plaquemine, La., revetment, \$150,000; Reid-Bedford Bend, \$87,404.63; dredges and dredging, \$2,506.99; Natchez and Vidalia Harbors, Miss., and La., \$1,564,506.80.

² Improving harbors at Natchez and Vidalia, Miss. and La., \$282,252.04; improving harbor at New Orleans, La., \$979,633.86; improving Atchafalaya and Red Rivers, La., \$1,001,709.40; survey east bank of Mississippi River from Warrenton to Baton Rouge, \$4,465.35.

³ Amount, \$133,316.80, previously reported increased 48 cents, received from sale of blue prints.

⁴ Includes \$13,820.62, reimbursable from other districts.

⁵ Does not include \$13,820.62, reimbursable from other districts.

Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1917—Continued.

FOURTH DISTRICT—Continued.

Appropriations.	Total.	Removing sunken vessels or craft ob- structing or endangering navigation; indefinite. ¹	Expended appropria- tions.	Grand total.	Expended contributed funds.
Amount expended on present project to end of last fiscal year...	\$19,252,287.93	\$6.11	² \$416,575.30	\$21,190,521.32	³ \$34,921.02
Balance unexpended at end of last fiscal year.....	41,195.13	7,993.89	.....	680,816.25	.....
Amount appropriated or allotted since (net).....	1,761,356.13	.....	.....	1,766,442.01	.....
	1,802,551.26	7,993.89	.....	2,447,258.26	.....
Amount expended from beginning of present fiscal year to end of previous month.....	630,410.38	7,993.89	.....	1,067,311.66	.....
Amount expended during the month.....	50,384.29	.....	.....	52,024.38	.....
	680,794.67	7,993.89	.....	1,119,336.04	.....
Balance unexpended at end of month.....	1,121,756.59	.....	.....	1,327,922.22	.....
In Treasury United States.....	1,049,366.23	.....	.....	1,189,547.08	.....
In hand.....	72,390.36	.....	.....	138,375.14	.....
	1,121,756.59	.....	.....	1,327,922.22	.....
Outstanding liabilities at end of month.....	131,282.58	.....	.....	131,282.58	.....
Amount covered by existing contracts at end of month.....	324,724.94	.....	.....	470,964.47	.....
	456,007.52	.....	.....	602,247.05	.....
Balance available at end of month.....	665,749.07	.....	.....	725,675.17	.....

¹ Removing wreck of bark Santos Amaral.² Emergencies in river and harbor works (for Giles Bend, Miss., \$40,000; for Old River, \$10,000), \$50,000. Maintaining and protecting levees of the Mississippi River and tributaries against floods (fourth district, \$141,786.32; Atchafalaya River and Bayou des Glaives, \$31,431.05), \$173,217.37. Removing sunken vessels or craft obstructing or endangering navigation, \$1,500. Rebuilding levees of Mississippi River and tributaries damaged by floods (Lower Tensas levee district, \$6,985.66; Lafourche levee district, \$105,318.56; Lake Borgne levee district, \$551.96; east bank Mississippi River from Vicksburg to Bayou Sara, \$23,402.56; sundry breaks Bayou des Glaives and Atchafalaya River, \$55,599.19), \$191,857.93.³ Funds contributed for improvement of Mississippi River at Avondale, La., \$32,467.28; funds contributed for improvement of Mississippi River at Torras, La., \$2,453.74.

APPENDIXES ACCOMPANYING THE ANNUAL REPORT OF THE MISSISSIPPI RIVER COMMISSION, FOR THE FISCAL YEAR ENDING JUNE 30, 1917.

Appendix 1.

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APPENDIX 1.

IMPROVEMENT MISSISSIPPI RIVER IN CHARGE OF THE SECRETARY, MISSISSIPPI RIVER COMMISSION.

REPORT OF MAJ. CLARKE S. SMITH, CORPS OF ENGINEERS, UNITED STATES ARMY, SECRETARY MISSISSIPPI RIVER COMMISSION, OFFICER IN CHARGE, FOR THE YEAR JUNE 1, 1916, TO MAY 31, 1917:

IMPROVEMENTS, ETC.

1. Mississippi River Commission.
2. Surveys, gauges, and observations.
3. Dredges and dredging.
4. Levees, Cape Girardeau, Mo., to Rock Island, Ill.

1. MISSISSIPPI RIVER COMMISSION.

The duties of the secretary under this allotment consist in payment of salaries and clerical, office, mileage, and miscellaneous expenses of the Mississippi River Commission; in the publication of the official reports and defraying the expenses of the semiannual and other trips of the commission, and the care and repair of the steamer *Mississippi*.

The Mississippi River Commission held four sessions during the year. The one hundred and thirty-fifth and one hundred and thirty-sixth sessions were held in St. Louis, Mo.; the one hundred and thirty-seventh on the United States steamer *Mississippi* from Rock Island, Ill., 510 miles above Cairo, to New Orleans, La., 967 miles below Cairo; and the one hundred and thirty-eighth on the steamer *Mississippi* from St. Louis, Mo., 191 miles above Cairo, to New Orleans, La.

The proceedings of these sessions and monthly reports of operations have been printed and issued.

Preliminary drawings and specifications of a new inspection steamer were completed.

For expenditures see money statements, pages 3439-3442.

2. SURVEYS, GAGES, AND OBSERVATIONS.

Location and description.—This work covers the Mississippi River from Head of Passes to the headwaters at Lake Itasca, a distance by river of 2,460 miles. The tributaries and Gulf coast at various places are also included for gages and observations. Surveys are made of the Mississippi River when ordered by the commission. Discharge measurements are made annually at all of 11 gaging stations on the Mississippi River and 11 stations on tributaries, at which river stages prescribed by the commission are reached during the year.

Original condition.—Lack of surveys and physical data made studies of the river incomplete.

Previous projects.—Various surveys and examinations have been made and maps published covering portions of the rivers in this district, but no comprehensive project had been adopted previous to the present one.

Existing project.—The existing project was adopted by act approved June 28, 1879, which reads in part as follows:

"Sec. 3. It shall be the duty of said commission to direct and complete such surveys of said river, between the Head of the Passes, near its mouth, to its headwaters, as may now be in progress and to make such additional surveys, examinations, and investigations—topographical, hydrographical, and hydro-metrical—of said river and its tributaries as may be deemed necessary; * * *"

Operations and results during the year.—The scientific records, maps, and construction drawings of the secretary's office have been catalogued and card indexed. The usual large number of requests for data of the Mississippi River have been complied with. A contract for printing maps was entered into, and the work was begun on printing maps of the resurvey of the Mississippi River, between high-water banks, from Cairo, Ill., to the mouth of Red River, La., a distance of 772 miles by river. This survey will be shown on 23 maps, scale 1 inch=1 mile, and on 63 detail charts, scale 1:20,000.

The printing of the annual pamphlet for the calendar year 1915, Stages of the Mississippi River and of its Principal Tributaries, in progress at last report, was completed; and this pamphlet for the calendar year 1916, now being printed, is 90 per cent completed.

The computation of discharge measurements taken during the year 1916 was completed and is now in progress on the discharge measurements taken during the high water of 1917.

The hourly readings for the calendar years 1915 and 1916 were scaled and tabulated from the rolls of the automatic tide gauges at Biloxi, Miss., and East Bay, La.

The hydrographs of the Mississippi River and tributaries for 1916 are being prepared in four sheets for blue printing. A hydrograph of the Mississippi River from Cairo, Ill., to Fort Jackson, La., for the period June 1, 1916, to May 31, 1917, is herewith, designated as plate 1.

The 185 high-water gauges on the Mississippi River from Cairo, Ill., to Head of Passes, La., were read during the high water March to May, 1917. The highest readings during the year on the regular and high-water gauges from Cairo to Head of Passes have been reduced to height above mean Gulf level and are given herewith in Table No. 3. The profile of the high water of 1917 from Cairo to Head of Passes has been plotted and is herewith, designated as plate 2.

The 38 regular gauges in charge of this office on the Mississippi River and tributaries have been inspected and maintained during the year. Continuous daily readings on these gauges have been observed and reported, and the readings have been tabulated and plotted on the office hydrographs. The automatic tide gauges at Biloxi, Miss., and East Bay, La., and the 185 high-water gauges on the Mississippi River from Cairo, Ill., to Head of Passes, La., have been inspected and maintained during the year.

The discharge of the Mississippi River was measured during the high water of 1917 at Columbus, Ky. (21 miles below Cairo), March 23 to 28; at Friar Point, Miss. (318), March 28 to April 14; at Chicot City, Ark. (432), April 2 to 18; at Vicksburg, Miss. (600), April 17 to 25; at Red River Landing, La. (765), and vicinity, including Atchafalaya River at Simmesport, La., and Old River at Torras, La., April 11 to 25; and at Carrollton, La. (957), April 24 to 30.

The high-water discharge of tributaries was measured during 1917 on the Cumberland River at Nashville, Tenn., 191 miles from the mouth, March 9 to 13; on the Tennessee River at Riverton, Ala., 225 miles from the mouth, March 12 to 16; on the Yazoo River at Redwood, Miss., 18 miles from the

mouth, April 22; and on the Black River at Jonesville, La., 54 miles from the mouth, April 27.

Overflow water on the right bank of the Mississippi River, passing between Arkansas City, Ark. (438), and Trippe, Ark., was measured May 2, 1917.

Precise levels were run connecting the nearest precise-level bench marks with the gauges at Plaquemine, Donaldsonville, and Bayou Sara, La.

In compliance with a provision of the river and harbor act of July 27, 1916, a survey was made of the Atchafalaya River from its head at Red River to Morgan City, La., including the main bayous and lakes between Grand River on the east and Grand Prairie on the west.

The field work of this survey was begun at Barbre Landing, La., October 28, 1916, by a party of 49, in charge of Junior Engineer H. R. Andress, and was completed March 24, 1917. The outfit used on this survey consisted of the steamer *Venus*, office and survey boat No. 5, 1 fuel barge, 2 motor boats—*Bolivar* and *Obion*, and 10 skiffs.

Condition at the end of year.—The general survey was completed in 1904, and maps have been published covering the entire river. Special surveys have been made of the lower river between the mouth of the Ohio River and Carrollton, La. (957), to determine changes in bank line and section; between Cairo, Ill., and Donaldsonville, La. (885), to determine the amount of bank erosion; and at various other localities for the collection of physical data. The survey for the restoration of the permanent marks of the general survey below Cairo, which was begun at Cairo in the fall of 1905, was completed to Donaldsonville, La., base line, 890.5 miles below Cairo, in January, 1910. A resurvey of the river between high-water banks from Cairo to mouth of Red River, a distance of 772 miles by river, begun at Cairo in 1911, was completed in January, 1914. Surveys were completed in February, 1914, in the vicinity of New Orleans, La., in connection with proposed spillways, to reduce flood heights. A survey of the Atchafalaya River, from Barbre Landing to the junction of the Little Atchafalaya and upper Grand Rivers, was made in 1904–1905. The field work of a survey of the Atchafalaya River, from its head to Morgan City, La., was completed in 1916–17. Gauges have been established and maintained at various places on the Mississippi River and tributaries and the Gulf of Mexico and the readings published. Discharge and other observations have been made on the Mississippi River and tributaries at various stations and the results published in part. Physical data have been compiled and card indexed. Printing maps, scale 1 inch=1 mile, and detail charts, scale 1:20,000, of the resurvey from Cairo, Ill., to the mouth of Red River, La., and reprinting charts and maps the supply of which is almost exhausted is in progress. The gauges are being maintained; computation of discharge measurements made in 1917 and printing of pamphlet, "Stages of the Mississippi River and its Principal Tributaries during 1916," are in progress.

Local cooperation.—None.

Effect of work.—The surveys, gauge readings, and other observations made and now being made furnish valuable data for the study of the river in formulating and perfecting plans for improvement.

Proposed operations.—It is proposed to publish the maps and charts now ready for publication, maintain gauges, make discharge and other observations, continue the collection and compilation of physical data, and make such other surveys and observations as may from time to time be ordered by the commission.

For expenditures see money statements, page 3441.

3. DREDGES AND DREDGING.

Location.—The portion of the Mississippi River included in this district for dredging extends over about 1,066 miles of river, from the mouth of the Ohio River to Head of Passes, La. The lower end of the district is 13½ miles from the Gulf of Mexico by South Pass and 19½ miles by Southwest Pass.

Original condition.—Depths of 5 and 5½ feet prevailed during low water on crossings in the upper portion of this district before operations were begun by the United States. Below the mouth of Red River the channel depths were ample for the requirements of navigation to the lower limits of this district.

Previous projects.—There had been no project for dredging by the United States in this district previous to the existing project.

Existing project.—The existing project was defined in the river and harbor act of June 3, 1896, carrying the first appropriation for this work, which was to be expended as follows:

" * * * In the construction of suitable dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down, not less than two hundred and fifty feet in width and nine feet in depth at all periods of the year except when navigation is closed by ice. * * *"

Operations and results during the year.—During the low-water season of 1916, four dredges—the *Gamma*, *Iota*, *Kappa*, and *B. M. Harrod*—were operated at 12 crossings from Foot of Toney's Chute, 78 miles below Cairo, to Cat Island, 256 miles below Cairo.

The first bar to require dredging was Bullerton (167). Only a small amount of dredging was done, August 15 to 17, when a rise in the stage rendered further work unnecessary.

At the beginning of August the Cairo gauge registered 26 feet, with a rapid and continued fall indicated. The *Kappa* and *Harrod* were prepared for service and after an inspection trip developed that the bars in some of the crossings were unusually high these two dredges were started up the river on August 9 and 11, respectively, the *Kappa* for Bullerton and the *Harrod* for Toney's.

A rise which commenced on August 11 at Cairo maintained project depths during the remainder of August. At the close of the month, however, the stage was falling rapidly, and there was no further material rise until late in December.

A low stage of 9.7 feet on the Cairo gauge and 6.4 feet on the Memphis gauge was reached late in September. The minimum for the season was 5.8 feet at Cairo and 2.8 feet at Memphis, on December 25 and 28, respectively.

The work performed by each dredge and place at which dredging was done is given in Table No. 7, accompanying.

The total amount of material moved by all these dredges during the season was 1,590,378 cubic yards.

Seventeen inspection trips were made with the steamer *Inspector M. R. C.* over stretches of the river from Head of Toney's Chute, 76 miles below Cairo, to Memphis, 230 miles below Cairo, and 13 inspection trips were made from Memphis to Cat Island, 256 miles below Cairo.

The least depths found at the various crossings are given in Table No. 5, accompanying.

Seventy-two surveys were made of 21 shoal crossings between Medleys, 30 miles below Cairo, and Angola and Smithland, 765 miles below Cairo. These surveys were made by parties on the survey boats *Mercury* and *Saturn*, and were for use primarily in connection with dredging operations. The dimensions of channels determined from these surveys are given in Table No. 6, accompanying.

The following is a brief description of the operations of each dredge, followed by a statement of conditions prevailing and results obtained at each of the bars where dredging was done during the low-water season of 1916.

Dredging operations—Dredge "Gamma."—The *Gamma* was placed in commission and left the dredge fleet (232) at 1.45 p. m., September 11, for Yankee Bar Crossing (170). It arrived at the crossing on the 15th at 7.50 a. m., commenced dredging at 3.20 p. m., and continued until 11.25 p. m. on the 19th, a satisfactory channel having been completed. The material encountered was blue mud with some sand.

The *Gamma* left Yankee Bar Crossing at 11.25 a. m., September 20, arrived at the crossing at the Foot of Island 26 (153) at 3.25 p. m. on the same day, and began dredging at 5 p. m. Dredging in that crossing was discontinued at 12 p. m. on the 25th, on account of a cracked flange on the copper main steam pipe to the high-pressure cylinder of the pumping engine. The work in this crossing was completed by the dredge *Kappa*.

The *Gamma* was taken to the dredge fleet for repairs, arriving there at 1.50 p. m., September 28, and was used there October 5 to 13 to remove a deposit of sand from the tracks of the marine railway dry docks. On October 20 the *Gamma* was moved to the mouth of Wolf River (229), and the crew was used on the construction of a dam in Wolf River below the head of the canal, while the dredge was awaiting a lower stage.

The *Gamma* was moved to the dredge fleet (232) December 4 to obtain coal, and left at 3.10 p. m. on the 5th for Yankee Bar Crossing (170), where it arrived at 1.30 p. m. on the 7th. Dredging in this crossing was commenced at 3.40 p. m. on the 7th and discontinued at 5.15 a. m. on the 8th, on account of a cracked flange in the main steam pipe to the pumping engine. The dredge was moved to Luxora, Ark. (161), on December 9, pending completion of repairs. It left Luxora on account of heavy running ice at 11.40 a. m., December 21, arrived at the dredge fleet at 12.20 p. m. on the 22d, and was withdrawn from commission December 23.

Dredge "Iota."—The *Iota* was withdrawn from work in Memphis Harbor (230) September 2, and was moved to the dredge fleet (232) to be prepared for river-channel work. The dredge left the dredge fleet at noon September 4 and arrived at Coahoma Crossing (248) at 2.30 p. m. Dredging in this crossing was commenced 3.50 p. m. on the 5th and was completed at 5 a. m. on the 8th, and the dredge was moved to the bank to await a lower stage.

On September 19 the dredge was moved out on the crossing to reopen a channel through a reef at the lower end of the crossing. While maneuvering into position the dredge was grounded and was not released until assisted by a pile sinker sent from the dredge fleet. The dredge was tied up at Coahoma, Miss. (248), at 11.30 a. m. on the 21st to wash boilers.

The *Iota* left Coahoma at 1.20 p. m., September 23, and arrived at Cat Island Crossing (256) at 4.30 p. m. Dredging was commenced in this crossing at 2.10 p. m. on the 24th and continued until 9.50 a. m. on the 29th. The dredge was moved to the bank and tied up to await a lower stage. The material encountered in this crossing was sand with a small amount of gravel. The depth of channel was increased from $7\frac{1}{2}$ to $10\frac{1}{2}$ feet.

The *Iota* remained at the bank at Cat Island Crossing (256) until 6.05 a. m., November 26, when it departed for the dredge fleet (232), arriving at 7.50 p. m. on the same day. No further dredging being required of this dredge, it was withdrawn from commission December 6, 1916.

Dredge "Kappa."—The *Kappa* was placed in commission and left the dredge fleet (232) at 5.30 a. m. August 9, and arrived at Drivers Landing (169), where it landed to clean boilers, at 2.20 p. m. on the 11th. The dredge left Drivers Landing at 7.30 a. m. on the 13th, taking the pontons to Bullerton Crossing (167). On account of trouble with the refrigerating plant, it was necessary to go to Osceola, Ark. (165), for ice. The dredge then returned to Drivers Landing, took the coal barge in tow which had been left there on account of the swift current, and arrived at Bullerton Crossing (167) at 5 p. m. August 13. Dredging was commenced in this crossing at 8.30 a. m. on the 15th, and was discontinued at 6.30 p. m. August 17, on account of the rising stage. The dredge moved up to Osceola Bar (164) on the 18th and remained there awaiting a lower stage until 8 a. m. August 26, when it departed for River Styx Crossing (139), arriving there at 9.50 a. m. August 27. Dredging in this crossing was commenced at 2.20 p. m. on the 27th and was continued until 11.30 a. m. September 1.

The *Kappa* was then moved to Round Lake Crossing (159), arriving there at 6 p. m. September 1. After cleaning boilers, dredging in that crossing was commenced at 3.15 p. m. on the 5th and continued until noon on the 9th, when the entire crew of firemen quit. A new crew was obtained and dredging was resumed on the 12th. An excellent channel through this crossing was completed at 5 p. m. September 17, and the dredge was moved to the bank to make repairs to the boilers while awaiting a lower stage.

These repairs were completed on the 26th and the *Kappa* was taken to Island 26 Crossing (153) to finish the work begun by the *Gamma*. Work in that crossing was completed at 5.30 a. m., September 29, and resulted in an excellent channel.

On September 29 the *Kappa* assisted the steamer *Inspector* in releasing two barges of coal which had been grounded in Round Lake Crossing (159). The dredge was then moved to the bank at Luxora, Ark. (161), to clean boilers and await a lower stage.

The *Kappa* was taken to Yankee Bar Crossing (170), October 4; dredging was commenced there at 6.05 a. m. on the 5th and was completed at 9.05 p. m. on the 7th.

The *Kappa* left Yankee Bar Crossing at 6.50 a. m., October 8, and arrived at Luxora, Ark. (161), at 11 a. m., remaining there until 2.15 p. m. on the 11th. The dredge was then taken to Flower Island Crossing (171). On account of insufficient deck crew dredging was not begun there until 7.45 a. m. on the 12th. Dredging was suspended at 5.35 p. m. on the 13th to repair the home section of the discharge pipe. A section of the *Flad's* pipe line was received from the dredge fleet and dredging was resumed at 6.25 p. m. on the 17th. At 9.10 a. m. on the 18th, one of the couplings in the pipe line broke, allowing some sections to go adrift. These sections were recovered by the dredge and towed back to the crossing on the 19th. No further dredging was required in this crossing.

The *Kappa* was moved to Upper Yankee Bar Crossing (170), and dredging was commenced there at 6.35 p. m., October 19. Work in this crossing was completed at 11.10 p. m. on the 21st, and resulted in a very satisfactory channel

through an extremely bad stretch of river. The material encountered was sand, with some mud.

The *Kappa* was moved up to Luxora, Ark. (161), October 22, and remained there awaiting a lower stage until November 7, when it was moved to Round Lake Crossing (159). Dredging was commenced in that crossing at 8.45 p. m. on the 7th, and was completed at 11.25 a. m., November 10. The dredge was then moved to Luxora, Ark. (161), to await a lower stage.

The *Kappa* remained at Luxora until 9.10 a. m., November 29, when it left for the dredge fleet (232), arriving there at 11 a. m. on the 30th. This dredge was withdrawn from commission December 6.

Dredge "B. M. Harrod."—The *Harrod* was placed in commission and left the dredge fleet (232) at 11.50 a. m., August 11, 1916, for Point Pleasant, Mo. (80). On arrival at Caruthersville, Mo. (110), at 4.30 p. m. on the 13th, the dredge was coaled, and a barge of coal was taken in tow. The dredge left Caruthersville at 10.30 a. m., August 15, and arrived at Point Pleasant at 1.30 p. m. on the 16th. It remained at Point Pleasant awaiting a lower stage until 10 a. m. on the 30th. On that date it was moved up to Toney's Crossing (78), and dredging was commenced at 3 p. m. and continued until midnight September 2. The dredge was then moved to the bank to await a lower stage. The material encountered in this crossing was sand.

The *Harrod* was moved to Darnells Crossing (82), September 5, where dredging was commenced at 6 p. m. on that date, and completed at 5.15 a. m. on the 9th. The dredge then went to Caruthersville (110) for coal.

The *Harrod* left Caruthersville at 9.30 a. m., September 10, and arrived at Gayoso Crossing (104) at noon. Dredging in that crossing was commenced at 6.45 p. m. on the 10th, and a satisfactory channel was completed at 12.10 a. m. on the 13th. The dredge was then moved to Caruthersville to await a lower stage.

The *Harrod* left Caruthersville at 6.15 a. m., September 18, and arrived at Darnells Crossing (82) at 8.45 a. m. on the 19th. Dredging was commenced in that crossing at 9 a. m. on the 20th, and a satisfactory channel with a least depth of 12½ feet was completed at 10.20 a. m. on the 23d. The dredge was then moved to the bank at Williams Point Landing to await a lower stage at 10 a. m. on the 25th; it was moved out into Point Pleasant Crossing (80) and dredging was commenced at 2 p. m. An excellent channel was completed at 4 p. m., September 28.

The *Harrod* left the bank at Williams Point at 10.15 a. m., September 29, and was moved to Caruthersville (110), where it remained until October 12. At 7.45 a. m. on that date the dredge left for Darnells Crossing (82) and arrived there at 9.45 a. m. on the 13th. Dredging in this crossing was commenced at 4 p. m. on the 13th and was completed at 6.40 p. m., October 20. The dredge was then moved to the bank at Williams Point. A considerable amount of mud was encountered in Darnells Crossing.

The *Harrod* was moved from Williams Point out into Point Pleasant Crossing (80) at 10.45 a. m. October 24. Dredging was commenced at 1.45 p. m. on that date and continued until 1.30 a. m. on the 25th, when a flange bolt in the coupling of the main pump shaft broke. Repairs were completed and dredging was resumed at 10.45 a. m. on the 26th. A satisfactory channel in this crossing was completed at 9.45 p. m., October 26, and the dredge was moved to the bank on the 27th to await a lower stage.

The *Harrod* was again moved out into Darnells Crossing (82) at 1.30 p. m., November 8, and dredging was commenced at 8.30 p. m. on the 9th. Dredging to widen some narrow places in the channel was completed at 8.30 p. m. on the 9th. The dredge was moved to the coal fleet (108), November 10, to obtain coal and await a lower stage. It left the coal fleet December 21, and arrived at the dredge fleet (232) at 9.45 a. m. on the 24th. The *Harrod* was withdrawn from commission December 27.

On account of heavy ice running in the river, and official weather predictions that running ice would be much increased, the dredges were moved to the dredge fleet while the river was still at a low stage.

The rapid decline in the stage of the river, coming at the time when running ice prevented the operation of dredges, caused the depth on several of the crossings to be reduced to less than 9 feet. It is impossible, however, to combat conditions brought about by freezing of the upper river and heavy running ice below Cairo. After the ice had passed there were indications of an immediate rise, which would improve channel conditions before improvement

could be secured by dredging. All dredges remaining in commission were withdrawn December 27.

In 1910, under similar conditions, an attempt was made to continue the dredges in operation. No good results were secured, since, as in the present case, the freeing of the river of ice was accompanied by a rise.

A statement of the cost of dredging operations from May 1, 1916, to April 30, 1917, is given in Table No. 4, accompanying.

Notes on conditions and results of dredging at each crossing below Cairo during the low-water season of 1916—Toneys Chute, 78 miles below Cairo.—The channel which was made through Toneys Chute in 1915 by the dredge *Henry Flad* was very greatly widened during the high water of 1916, only one comparatively short shoal being left at the lower end of the chute. This shoal was dredged by the *Harrod* with excellent results, shown by a comparison of the maps of August 28 and September 4. A good channel was maintained through the entire season without further dredging.

Point Pleasant, 80 miles below Cairo.—This was a troublesome crossing, on account of the fact that the current divided on the head of a bar, a large volume flowing to the right of the bar and in to the bank below Point Pleasant Landing. The greater draft of water was to the left of the bar and out to a middle bar, where it made an abrupt turn to the right and back in to the bank, joining the upper current in the bend below Point Pleasant.

Dredging was first required only in that part of the channel leading out to the middle bar, but the caving of this bar caused a deposit in the lower crossing leading in to the bank, which also required dredging later. After this channel was opened no further dredging was required.

Darnells, 82 miles below Cairo.—Dredging was required four times to maintain a channel of project dimensions through this crossing. There were three distinct shoals, aggregating in length 5,500 feet. The first one developed at the upper end of the crossing early in September. Soon after the completion of a channel through this shoal it was necessary to extend the cut nearly 2,000 feet downstream. This, in connection with the first dredging, made a dredged channel 4,000 feet long and of project width.

On October 12 a shoal having developed in the bend at the extreme foot of the crossing, the *Harrod* was placed in position and commenced dredging a channel through this shoal.

Early in November it became evident that the upper end of the dredged channel was deteriorating and more work would be required to maintain project dimensions. On November 8, therefore, the *Harrod* was placed in position, and the channel was improved by widening and deepening at the extreme upper end of the crossing.

It was only by extreme vigilance and persistent dredging that a channel of project dimensions was maintained through Darnells Crossing throughout the low-water season.

Gayoso, 104 miles below Cairo.—An excellent channel was secured in this crossing by 2½ days' dredging by the *Harrod*, September 10 to 13.

River Styx, 139 miles below Cairo.—Five days' dredging by the *Kappa*, August 27 to September 1, was sufficient for the maintenance of the channel through this crossing.

Foot of Island No. 26, 153 miles below Cairo.—In the early part of the season the channel at the foot of Island 26 was close down by the foot of the island, but a survey made on September 6 showed indications of a new channel passing the foot of the island about one-half mile off. On September 17 this new channel had greatly improved from natural erosion and was selected for further improvement by dredging. Five days' dredging by the *Gamma*, September 20 to 25, and two days by the *Kappa*, September 27 to 29, completed an excellent channel, which required no further dredging during the low-water season.

Round Lake, 159 miles below Cairo.—Early in the season it was evident that Round Lake would give trouble, one reason being the large volume of water that was diverted through the Chute Island No. 30. Before dredging in Round Lake Crossing the channel through the chute was deeper by 2 feet than that through Round Lake Crossing.

As it was the desire of the commission to maintain a channel around by Luxora, if possible, the Round Lake Crossing was dredged, and in spite of the greater volume of water passing through the chute of island 30, project depths of channel were maintained during the season. To accomplish this, however,

required nine days' dredging by the *Kappa* in September and three days in November.

Bullerton, 167 miles below Cairo.—A map platted from survey of September 8 and 9 discloses a network of narrow channels between bars, which made it evident that in any route selected for a crossing the channel would be shallow, narrow, and tortuous and obstructed by several shoals which would require dredging and could be maintained of project dimensions only with great difficulty.

The first dredging was required at a reef extending out from the foot of Yankee Bar, and was done by the *Gamma* about the middle of September. Three other distinct and separate shoals were later dredged—Middle and Upper Yankee Bar and Flower Island, the last at the extreme lower end of the crossing. Map of October 3 shows only 8½ feet in the Middle Yankee Bar Shoal. This condition existed only for a very few days before dredging by the *Kappa* October 5 to 7, and was caused by heavy caving at the head of Yankee Bar which dropped immense quantities of sand into the current to be deposited on reefs below.

Coahoma, 248 miles below Cairo.—Only a comparatively small amount of dredging was required in this crossing, although late in the season a new natural channel developed about three-fourths of a mile above the dredged cut and the dredged channel filled up.

Cat Island, 256 miles below Cairo.—Channel depths in this crossing were less than project requirements for a few days in September, owing to the fact that on account of the demands on the personnel and plant by work in Memphis Harbor just at this time pilots of private boats were depended upon to report the development of any shoals in the lower river.

The shoal at Cat Island developed very quickly and for about a week there was only 8 feet over the reef. Dredging by the *Iota* produced an excellent channel and no further work was required.

Memphis Harbor.—On account of the formation of a mud bar in Memphis Harbor (230), dredging operations were begun May 12, 1915, conformably with a resolution of the Mississippi River Commission, April 18, 1915, "to do such temporary dredging as may be necessary to provide access to the Memphis Harbor during the present season."

The plan and provision for permanent improvement of Memphis Harbor is stated in the following resolution of the Mississippi River Commission, November 20, 1915:

"1. That the general features of the project submitted by the first and second districts officer for the improvement of Memphis Harbor by the diversion of the waters of the Mississippi River through the Loosahatchie and Wolf Rivers, along the harbor front, be approved.

"2. That such plant pertaining to dredges and dredging as may be needed for the work proposed may be assigned thereto and operated under the direction of the secretary, the expenditure therefor to be made from the allotment for dredges and dredging to the extent of \$75,000."

For the permanent improvement of the harbor it was proposed to dredge a channel from a point on the harbor front near the foot of Jefferson Avenue, station 0+20, to a point on Wolf River about 2,000 feet above its mouth, and to construct a sheet piling or earth dam across Wolf River below the upper end thereof. The purpose of the dam was to increase the scouring effect in the harbor by forcing the water of the Mississippi through the Loosahatchie and Wolf Rivers along the Memphis front.

The channel as proposed was 3,000 feet long, with a bottom width of 50 feet at 5 feet below zero of the Memphis gauge, and side slopes of 2 to 1. It was estimated that its completion would require the removal of 435,947 cubic yards of material, of which 253,000 cubic yards had been removed on May 30, 1916.

Operations for completion of the project as above provided for were continued under the direction of the secretary Mississippi River Commission until December 1, 1916, when all uncompleted work on the project was transferred to the first and second districts officer, necessary dredging plant to be furnished by the secretary.

Surveys of the harbor made December 13, 1915, and May 16, 1916, showed that between those dates a deposit from 8 to 12 feet in depth had been made between the crest of the bar and the high-water line on the wharf. A survey made June 26, 1916, showed an additional deposit which raised the bar across the entrance to the harbor to a height of 14 feet on the Memphis gauge.

Dredging in the harbor extended 3,200 feet downstream from the foot of Jefferson Avenue (station 0+20 on the canal line) to a point below the foot of Peale Avenue. The dredge *Zeta* was placed in the upper part of the harbor May 23, 1916, to extend the channel work which had been done by the *Epsilon* through the low ground below the lower end of the channel. Dredging was commenced at 1.25 a. m. May 27, the material being discharged to the west of the channel. During part of June the *Zeta* was engaged in deepening a cut made by the dredge *Cincinnati*. Dredging by the *Zeta* in the upper end of the harbor was continued until July 15, when the dredge was moved farther up the channel. The *Zeta* dredged in the channel until July 31, and from that date until August 14 in the lower end of the harbor.

On July 11 the dipper dredge *Cincinnati* commenced dredging in the harbor, and on the 15th had completed a channel through the bar at the entrance to the harbor. The dredge was then moved farther upstream, where it was operated until September 5. On that date it began dredging in the upper end of the harbor in conjunction with the *Epsilon*, removing a serious slide in the channel between Court and Jefferson Streets. The *Cincinnati* also dredged from the sides of the cut, this work being completed September 26. The *Cincinnati* was again used in the harbor November 1 to 30, widening the channel opposite the wharf boats and removing mud from the harbor. The dredged material was loaded into scows and towed out into deep water and dumped.

The dredge *The Ram* was operated in the lower part of the harbor June 6 to 16, and preparations were commenced for returning the dredge to the fourth district officer at New Orleans, La.

The *Iota* was used August 22 to September 2 cleaning mud from the harbor below the wharf boats.

The *Epsilon* was operated in the lower part of the harbor from September 6 to October 20 on maintenance of the harbor, and from November 14 to 30 on maintenance of the entrance to the harbor.

The amount of material to be removed from the harbor was greatly increased by material sliding in from the bar and by a large deposit left by the June rise. About 480,475 cubic yards were dredged in the harbor. Depths in the latter were increased from about 12 or 14 feet on the gauge to 6 feet below zero of the gauge. Navigable depths in the harbor were maintained at all times.

The total excavation in the harbor and in the canal was 946,248 cubic yards, at a total cost of \$100,982.80, or 10.67 cents per yard. The cost per cubic yard in the harbor was 5.68 cents, the lower cost being due to softer material, absence of obstructions, and low banks.

Wolf River Dam.—In order to derive the full benefit of the erosive effect of the current along the wharf it was necessary to obstruct one of the channels by a dam. The dam was not required to withstand much lateral pressure, and an especially durable structure was not deemed necessary, as it was very probable that the old channel would soon be filled with sediment. The only serious dangers to be provided against were flanking of the ends and erosion of the bottom around the piles.

The dam as first designed was to consist of a row of piles spaced 5 feet apart, and vertical timbers held in place by two horizontal waling pieces, one at the top of the piles and the other 10 feet below or at the water surface at the time of construction. Erosion was to be prevented by a foot mat. This design contemplated construction with floating plant. A rapid fall in the stage of the river during August and September made dry construction necessary. Even in the deepest part of the channel there was not sufficient water to float a pile driver. Spoil from the channel had caused a fill which greatly reduced the cross section on the site of the proposed dam. At the lowest point the top of the mat was 8 feet above the zero of the Memphis gauge.

In order to quickly stop all low-water flow through Wolf River pending completion of the dam, a small rock dike 100 feet long and with crest at 13 feet on the gauge was built across the channel. This proved to be effective in maintaining a current in the harbor during the low-water season.

When dry construction of the dam became necessary the design was changed by substituting 2-inch oak sheathing for the vertical timbers. Early in September 3 foot mats were sunk on the dam site from the 20-foot contour on the north side of the channel to the 20-foot contour on the south side. The driving of piling through this mat was begun with a floating driver, but only a few were driven when the falling stage made it necessary to use a skid driver. The leads and engine were moved from pile sinker No. 13 and placed

on skids on the mat, and a steam line was run from the boiler on the pile sinker. Driving by this method was commenced October 4. Waling pieces 12 inches thick were bolted to the piles, and the work of placing the sheathing followed immediately. The dam was completed November 30, except for some braces on the lower side.

Additional protection against erosion was provided for by bank revetment extending 100 feet upstream and 150 feet downstream from the upper and lower edges of the foot mats respectively. This revetment covered the bar formed just below the dam by material excavated from the channel.

The cost of the dam was \$3,309.45, and of the mat, shore, and bottom protection \$16,537.96. The revetment work was done by the first and second Mississippi River districts office.

Dredge depot at West Memphis, Ark.—Buildings and plant on land owned by the United States have been cared for and repaired, and a great amount of work incident to the care of a large fleet and its maintenance in a state of efficiency has been done.

Plant.—During the year the following plant pertaining to this project, when not in operation, has been cared for at the fleet at West Memphis, Ark.:

Dredges <i>Beta, Gamma, Delta, Epsilon, Zeta, Iota, Kappa, Henry Flad,</i>	
and <i>B. M. Harrod</i>	9
Steamboats <i>Sachem, Choctaw, Nokomis, Leota, Wynoka, Inspector M. R. C., Saturn, Jupiter, Venus, Vulcan, Mercury, and Mars</i>	12
Pile sinkers Nos. 13, 971, 981, 982, and 983	5
Derrick boat <i>M. R. C. No. 1</i>	1
Barges Nos. 041 and 051	2
Pump boat	1
Quarterboat <i>Wabash No. 3</i>	1
Gasoline launches	3
Calking flats	1
Sectional dock, sections	6

The *Inspector M. R. C., Saturn, Jupiter, Venus, Mercury, Vulcan, and Mars* were used at different times as fleet tenders during the lay-up season.

Buildings and grounds.—Buildings and grounds were cared for during the year.

Marine ways—Repairs.—Minor repairs were made during the year, and mud deposited by high water was removed from the gear pits and tracks.

OPERATION.

Plant.	Docked.	Shifted.	Un-docked.
Snag boat <i>John N. Macomb</i>		May 15, 18, 19.	May 19
Dredge <i>Iota</i>	June 9		June 26
Pile sinker No. 933	June 26		July 7
Barge No. 051	July 10		July 13
Dredge <i>Henry Flad</i>	July 24	July 26.	July 31
Concrete Mixer No. 1238	Aug. 23		Oct. 13
Steamer <i>Mississippi</i>	Oct. 14		Dec. 15
Barge No. 051	Dec. 18		Jan. 22
Dredge <i>Kappa</i>	Jan. 22	Feb. 19.	Jan. 29
	Feb. 17		

Ways in use	days	305
Ways idle	do	61
Dredge fleet boats docked		4
Dredge fleet barges docked		2
Dredge fleet pile sinkers		1
Boats of other engineer districts		2
Mud scows docked		1
Number of dockings		9
Number of undockings		9
Character and number of craft handled:		
Dredges		3
Steamboats		1
Snag boats		1
Floating concrete mixers		1
Pile sinkers		1
Mud scows		1
Barges		2

Total tonnage handled	tons	4, 737
Maximum load handled at any docking	do	1, 160
Average load handled	do	526
Total cost of operation		\$284. 19
Total cost of repairs		\$472. 97
Cost of docking per ton		\$0. 06
Cost of docking per ton (repairs included)		\$0. 16

Coal.—Twenty-four barges of Baker lump coal, containing 13,050.35 tons; 20 barges of mine-run coal, containing 11,765.66 tons; and 15 barges of pea and slack coal, containing 8,406.50 tons, were purchased from the West Kentucky Coal Co. under contract. Open-market purchases aggregating 3,698.6 bushels were purchased at various places along the river by boats in transit.

The steamer *Jupiter*, with pile sinker No. 971 in tow, left the dredge fleet May 27 for Caruthersville, Mo. (110), for the purpose of receiving and caring for the coal to be delivered there under contract. The *Jupiter* returned to the dredge fleet on June 3. Pile sinker No. 971 was later transferred to work in the Ohio River, and was returned to the dredge fleet December 20. Pile sinker No. 981 was taken from the dredge fleet to replace No. 971 at the coal fleet.

The coal fleet located at Caruthersville, Mo., was cared for at that place until the close of the dredging season, when it was moved to the dredge fleet by the steamer *Leota*.

Subsistence.—All employees were furnished subsistence in kind. During the year 95,566 rations were served at a cost of \$0.5051 raw and \$0.6184 served, including wages of cooks, waiters, and all necessary labor in caring for quarters.

Inspection of floating plant.—The requirements of the inspection service are or will be fully complied with on all floating plant placed in commission for service.

New plant.—No new plant was built during the year.

Condition at the end of year.—A navigable channel has been maintained since 1895, and a channel of project dimensions has been maintained since 1902, except as follows: For 18 days in 1903 and a few days in 1904 the depths at one bar were 8 and 8½ feet. For a few days there was less than 9 feet at five bars in 1908, seven bars in 1910, five bars in 1914, and two bars in 1916. At one bar in 1913 and four bars in 1916 the required width was not maintained.

The project depth of 9 feet with width of 250 feet was exceeded at all bars below Cairo at the end of the year.

Local cooperation.—None.

Effect of improvement.—Continuous navigation of the river below Cairo by river steamboats has been made possible.

Proposed operations.—It is proposed to operate as many units of dredging plant as may be necessary to fully maintain the project during the low-water season, to maintain the dredging plant in a state of efficiency, and make bar surveys in connection with dredging operations.

For expenditures see money statements, page 3441.

4. LEVEES: CAPE GIRARDEAU, MO., TO ROCK ISLAND, ILL.

Location and description.—The portion of the Mississippi River included in this section for levees extends over about 452 miles of river, from Cape Girardeau, Mo., 55 miles above Cairo, to near Rock Island, Ill., 507 miles above Cairo.

The district embraces 13 basins on the west bank of the river with an area of 546 square miles and a river frontage of 228 miles and 9 basins on the east bank of the Mississippi River with an area of about 708 square miles and a river frontage of 270 miles.

Original condition.—The lands adjacent to the river on either side were subject to overflow at high water, the overflow extending from bluffs to bluffs. An area of about 980 square miles was partially protected from overflow by levees constructed by 42 local levee and drainage districts. Fourteen of these local districts, having an area of about 315 square miles with a river frontage of 96 miles, were located on the west bank of the river, and 28 districts, having an area of about 665 square miles with a river frontage of about 257 miles, were located on the east bank. While the expenditures for levees by local districts prior to June 30, 1915, amounted to about \$6,000,000, the levees were not adequate to control the floods that occur at intervals in this portion of the river.

Previous projects.—No comprehensive project for levees in this section have been adopted prior to March 4, 1913.

Levee work had been done at three localities previous to the existing project, with a total expenditure by the United States for construction, preservation, and repair of these levees as shown in the statement below:

Flint Creek to Iowa River (430 to 460 ¹ R.)-----	\$346,325.54
Warsaw to Quincy (348 to 381 ¹ L.)-----	105,500.00
Sny Island Levee (282 to 335 ¹ L.)-----	106,728.99

Total-----	558,554.53
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The funds used for work pertaining to these levees were provided by river and harbor acts of July 5, 1884; August 5, 1886; August 11, 1888; September 19, 1890; July 13, 1892; June 3, 1896; and June 13, 1902; and by sundry civil acts of March 2, 1895, and March 3, 1899.

Present project.—The present project is to build or enlarge certain levees to a grade and section sufficient to protect adjacent lands from overflow. This project was adopted in 1913.

Above the mouth of the Missouri River the levees are to be built or enlarged to a section having a crown width of 6 feet with side slopes 1 on 3. The established grade is usually 3 feet above the highest known flood. Below the mouth of the Missouri River the levees are to be built to the standard section, crown width of 8 feet, river slope 1 on 3, land slope 1 on 3, to 8 feet below crown, thence a banquettes 20 to 40 feet in width, with back slope 1 on 4.

Operations and results prior to the fiscal year.—Under the present project, work has consisted in the construction and enlargement of certain levees. The expenditures by the United States for levees, under this project prior to the beginning of the fiscal year, are shown in the following statement:

East Cape Girardeau and Clear Creek drainage district, Ill. (47 to 60 ¹ L.)-----	\$20,000.00
East Side levee and sanitary district, Ill. (185 to 208 ¹ L.)-----	60,000.00
Elsberry drainage district, Mo. (267 to 281 ¹ R.)-----	37,753.81
Sny Island levee drainage district, Ill. (282 to 335 ¹ L.)-----	24,370.75
Hunt drainage district, Ill. (368 to 380 ¹ L.)-----	14,702.06
Muscatine Island levee district, Iowa (467 to 480 ¹ R.)-----	99.91

Total-----	156,926.53
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The work has been successful in increasing the amount of protection afforded by the levees.

Operations and results during the fiscal year—Warsaw to Quincy, Ill. (381 to 348¹).—Under the allotments of \$20,000 from the funds carried by the river and harbor act of March 4, 1913, and \$30,000 from the funds carried by river and harbor act of July 27, 1916, for levees in this locality enlargement work between stations 0 and 180 of the Hunt Levee (377 to 380¹ L.), under contract with Cameron, Joyce & Co., uncompleted at the end of the previous year, was continued. A total of 17,674 cubic yards was placed during the year at 20½ cents per cubic yard. It is proposed to expend the balance available under the allotments mentioned above in extending the enlargement of the Hunt Levee as far downstream as the funds will permit.

Quincy to Hamburg Bay, Ill. (348 to 282¹).—Under the allotment of \$60,000 for levees in this locality from the funds carried by the river and harbor act of March 4, 1913, no work was done on the enlargement of the Sny Island Levee between stations —18 and 482 (335 to 226¹ L.) under contract with the Bondurant Construction Co., uncompleted at the end of the previous year, and the contract was annulled.

It is proposed to expend the available balance of this allotment, together with the allotment of \$70,000 for levees in this locality, from the funds carried by the river and harbor act of July 27, 1916, in completing the work formerly covered by the contract with the Bondurant Construction Co., and in extending the enlargement downstream as far as the funds will permit.

La Grange to mouth of Missouri River, Mo. (357 to 208¹).—The allotment of \$20,000 for levees in this locality from the funds carried by the river and harbor act of July 27, 1916, is being expended in constructing a new levee along the Mississippi River in the Riverland Levee district, Mo. (312 to 305¹). This is a new district with an area of about 6,229 acres. The district plans the construction of about 14 miles of levee embankment, averaging about 11 feet in

¹ Miles above Cairo.

height, extending from the bluffs near Ashburn, Mo., across the north end of the district 0.8 mile to the Mississippi River at Mundy Landing (312¹ R.), thence downstream along the bank of the Mississippi River 7.5 miles to near the mouth of Salt River, thence up that stream along its left bank a distance of 5.7 miles to the bluffs near Riverland Station, Mo. The run-off from rainfall in the district will be carried through drainage ditches to a pumping station in the lower end of the district and pumped over the levee into the river.

A contract was entered into with Fred C. Morgan on May 11, 1917, for the construction of 110,000 cubic yards of embankment between station 0, at Munday Landing, and station 80 at 16 cents per cubic yard. Work under this contract commenced May 17, and 8,907 cubic yards had been placed prior to June 1, 1917.

Head of Chouteau Island to Prairie du Pont, Ill. (208 to 185¹).—The allotment of \$25,000 for levees in this locality from the funds carried by the river and harbor act of July 27, 1916, is being expended in closing a gap between stations 886 and 895 of the front levee in the East Side Levee and sanitary district, Ill. A contract was entered into with the Hillsboro Dredging Co. on January 17, 1917, for placing 40,000 cubic yards of embankment by the hydraulic method at 35 $\frac{1}{4}$ cents per cubic yard. Work under this contract commenced May 9, and a total of 662 cubic yards had been placed prior to June 1, 1917.

Grand Tower to Gale, Ill. (8 $\frac{1}{2}$ to 48¹).—The allotment of \$20,000 for levees in this locality from the funds carried by the river and harbor act of July 27, 1916, is being expended in reconstructing and enlarging a part of the levee in the East Cape Girardeau and Clear Creek drainage district, Ill. (60 to 48¹ L.). On December 29, 1916, a contract was entered into with Roach & Stansell for 100,000 cubic yards of reconstruction and enlargement work between stations 63+67 and 173 of this levee at 15.38 cents per cubic yard. Work under this contract commenced February 21, and a total of 41,217 cubic yards had been placed prior to June 1, 1917.

Condition at the end of the fiscal year.—For complete report on examination of this district by the Mississippi River Commission, with recommendations, see House Document 628, Sixty-third Congress, second session.

The work under contract is approximately 90 per cent complete. Plates 3, 4, 5, 6, 7, 8, 9, and 10 accompanying show present levee grades with relation to the project grades, and plates 11, 12, and 13 show location of levees.

Local cooperation.—The expenditures for levees by local levee boards in localities where expenditures have been made or proposed by the United States under this project are shown by the following statement:

Drury drainage district, Ill.....	\$148,803.69
Muscatine Island levee district, Iowa.....	76,471.14
Henderson County drainage district No. 1, Ill.....	116,812.00
Hunt drainage district, Ill.....	272,800.00
Sny Island levee drainage district, Ill.....	1,517,911.77
Riverland levee district, Mo.....	55,081.28
East Side levee and sanitary district, Ill.....	3,332,289.06
East Cape Girardeau and Clear Creek drainage district, Ill.....	144,778.30
Total.....	5,664,947.24

Effect of improvement.—Added protection has been given against overflow to about 222,000 acres of land.

Proposed operations—Rock Island to New Boston, Ill. (508 to 458¹).—It is proposed to expend the allotment of \$15,000 for levees in this locality, from the funds carried by the river and harbor act of July 27, 1916, in the reconstruction of a part of the levee in the Drury drainage district, Ill. This district is in Rock Island County, Ill., the upper limit being at Drury Landing and the lower limit at Copperas Creek. The district has a frontage of 8.5 miles on the Mississippi River, from 476.5 to 485 miles above Cairo. The existing levee, beginning at the bluffs about 3 miles above the bridge over the Mississippi River at Muscatine, Iowa, runs due north about one-half mile to Drury Landing, thence downstream along the east bank of the Mississippi River 7 miles, to the mouth of Copperas Creek, thence along the right bank of Copperas Creek 2 miles to ground above probable overflow. The area of protected land in the district is 5,300 acres, assessed valuation is given at \$80,000 and the expendi-

¹ Miles above Cairo.

tures by the local district authorities for levees and drainage is stated to amount to \$114,997. The proposed work will begin at the upper end of the district and will extend downstream as far as available funds will permit.

Muscatine to mouth of Iowa River, Iowa (481 to 460').—It is proposed to expend the allotment of \$30,000 for levees in this locality, from the funds carried in the river and harbor act of July 27, 1916, in reconstructing the Muscatine Island Levee between stations 142+50 and 328. The levee of the Muscatine Island district extends from a point just south of Muscatine, Iowa, to Port Louisa, Iowa, excepting where high ground exists about the halfway point along the Mississippi front. The upstream stretch of levee is 5 miles in length, and the downstream portion about 5.6 miles. The levee contains such a combination of defects as to render its relocation and reconstruction desirable. At Port Louisa the levee joins the levee in the Muscatine-Louisa drainage district No. 13. The combined area of the two districts is about 21,350 acres.

Oquawka to Dallas, Ill. (441 to 414').—Under the allotment of \$20,000 for levees in this locality from the funds carried by the river and harbor act of July 27, 1916, it is proposed to enlarge a part of the levee along the Mississippi River in Henderson County drainage district No. 1. This district is located in Henderson County, Ill., 428 to 436 miles above Cairo. The levee begins at the embankment of the Keithsburg branch of the Chicago, Burlington & Quincy Railroad, runs 2 miles along the south side of the Henderson River diversion channel to near the Mississippi River, thence downstream along the river about 8 miles to the railroad bridge across the Mississippi River at Burlington. The existing levee has an average height of about 12 feet and contains about 850,000 cubic yards of material. The area of the district is 7,680 acres. The work proposed will commence at the upstream end of the levee along the Mississippi River and extend downstream as far as funds will permit.

The following papers and plates accompany this report:

Money statements.

Abstract of contracts in force.

Commercial statistics.

Statement of charts issued and sold.

Table No. 1. Highest and lowest gauge readings in 1916, Mississippi River and tributaries.

Table No. 2. Highest gauge readings of 1917, Mississippi River and tributaries.

Table No. 3. Maximum height of high water above mean Gulf level, 1917, Cairo to Head of Passes.

Table No. 4. Cost of dredging operations, May 1, 1916, to April 30, 1917.

Table No. 5. Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1916.

Table No. 6. Dimensions of channels through bars, Mississippi River below Cairo, dredging season of 1916.

Table No. 7. Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1916.

Plate No. 1. Hydrograph of Mississippi River, Cairo, Ill., to Fort Jackson, La., June 1, 1916, to May 31, 1917.

Plate No. 2. Profile of high water of 1917, Mississippi River, Cairo, Ill., to Head of Passes, La.

Plate No. 3. Profile of Drury Levee.

Plate No. 4. Profile of Muscatine Island Levee.

Plate No. 5. Profile of levee in Henderson County Drainage District No. 1, Ill.

Plate No. 6. Profile of Hunt and Lima Lake Levee.

Plate No. 7. Profile of Sny Island Levee.

Plate No. 8. Profile of Riverland Levee.

Plate No. 9. Profile of Front Levee, East Side Levee, and Sanitary District.

Plate No. 10. Profile of East Cape Girardeau Levee.

Plate No. 11. Location of levee work, Rock Island to Nauvoo.

Plate No. 12. Location of levee work, Nauvoo to Alton.

Plate No. 13. Location of levee work, Alton to Thebes.

Appendix 1A. Laws affecting the Mississippi River Commission July 1, 1916, to June 30, 1917.

CLARKE S. SMITH,
Major, Corps of Engineers, United States Army.

¹ Miles above Cairo.

MONEY STATEMENTS.

APPROPRIATION FOR IMPROVING MISSISSIPPI RIVER.

July 1, 1916, balance unexpended	\$72,054.90
Amount received from sale of Engineer property, credited under the provisions of section 5 of river and harbor act of June 13, 1902, in month named, to allotment stated: March, 1917. "Dredges and dredging"	\$1,000.50
Amount received in November, 1916, from sale of steamer Wynoka (E. D. 87050-421 Sec. MRC. 2284-10) credited to "Dredges and dredging"	20,000.00
Amount allotted from appropriation by river and harbor act of July 27, 1916, approved by the Acting Secretary of War August 14, 1916 ("Mississippi River Commission," \$50,000; "Surveys, gauges, and observations," \$60,000; "Dredges and dredging," \$250,000; "Levees Cape Girardeau, Mo., to Rock Island, Ill.," \$230,000)	590,000.00
Amount, \$15.76, arising from refundments pertaining to extinct or unknown allotments, less debit of Treasury settlement No. 13704, December 26, 1900, as reported by the Chief of Engineers, U. S. Army, June 23, 1916, and credited to allotment for "Mississippi River Commission," December, 1916	14.02
	<u>611,014.52</u>
	683,069.42

June 30, 1917, amount expended during fiscal year.....¹ 206,645.84

July 1, 1917, balance unexpended	476,423.58
July 1, 1917, outstanding liabilities	35,635.61
July 1, 1917, amount covered by uncompleted contracts	150,397.66
	<u>186,033.27</u>
July 1, 1917, balance available	290,390.31

APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND HARBOR WORKS.

July 1, 1916, balance unexpended	² 357,647.48
Amount received from sale of contract prints, credited under the provisions of section 5 of river and harbor act of June 13, 1902, in December, 1916, to allotment for "Surveys, gages, and observations"	.79
Total	<u>357,648.27</u>

¹ Includes \$1,191.28 reimbursable as follows: \$740 from appropriation for Army transportation fiscal year, 1916-17 (Engineer operations in the field); \$451.28 from St. Louis district office.

² The amount, \$357,642.53, reported in annual report for 1916, has been increased \$4.95, being refundments, in the months stated, of the following overpayments:

October, 1916, vouchers 119, 188, 189, 190, and 191, January, 1916, \$0.15, \$0.35, \$0.35, \$0.20, \$0.20, respectively (surveys, gauges and observations)	\$1.25
October, 1916, voucher 66, January, 1916 (dredges and dredging)	.10
January, 1917, vouchers 66 and 208, January, 1916, and April, 1916, \$0.15 and \$0.25, respectively (dredges and dredging)	.40
August, 1916, voucher 9, December, 1915 (Mississippi River Commission)	.75
October, 1916, vouchers 63 and 64, March, 1916, \$0.40 and \$0.25, respectively (Mississippi River Commission)	.65
October, 1916, vouchers 24, 25, 28, 54, 94, and 96, March, 1916, \$0.10, \$0.10, \$0.30, \$0.25, \$0.10, \$0.10, respectively (surveys, gauges, and observations)	.95
February, 1917, vouchers 60, 61, and 62, March, 1916, and voucher 31, April, 1916, \$0.15, \$0.15, \$0.15, and \$0.25, respectively (surveys, gauges, and observations)	.70
October, 1916, voucher 65, March, 1916 (dredges and dredging)	.15
Total	<u>4.95</u>

3476 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

June 30, 1917, amount expended during fiscal year for improvement and maintenance	\$246, 158. 61
July 1, 1917, balance unexpended	111, 489. 66
July 1, 1917, balance available	111, 489. 66

APPROPRIATION FOR GAUGING WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.¹

July 1, 1916, balance unexpended	² \$1, 631. 70
Amount allotted by Chief of Engineers from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902	9, 100. 00
	10, 731. 70
June 30, 1917, amount expended during fiscal year	\$8, 313. 92
June 30, 1917, amount reverted to Treasury during fiscal year	646. 09
	8, 960. 01
July 1, 1917, balance unexpended	1, 771. 69
July 1, 1917, outstanding liabilities	906. 59
July 1, 1917, balance available	865. 10
Amount that can be profitably expended in fiscal year ending June 30, 1919	9, 100. 00

ITEMIZED STATEMENT OF EXPENDITURES DURING THE FISCAL YEAR ENDING JUNE 30, 1917, SUBMITTED IN COMPLIANCE WITH REQUIREMENT OF SECTION 6 OF RIVER AND HARBOR ACT OF AUG. 11, 1888.

Observations:

Pay of permanent gauge observers \$3, 568. 50

Inspections and repairs:

Inspection of gauges on Mississippi River by junior engineers and parties on steamers \$1, 602. 16
 Inspection of gauges on tributaries 205. 19
 Renewals and repairs of gauges and bulletins 161. 96
 1, 969. 31

Office expenses and contingencies:

Pay of assistant and junior engineers, surveyors, and clerks 2, 214. 12
 Stationery, printing, office rent, etc 561. 99
 2, 776. 11

Total 8, 313. 92

APPROPRIATION FOR GAUGING WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.

Allotments from general appropriations for examinations, surveys, and contingencies of rivers and harbors by acts of—

Mar. 3, 1871 (allotment Apr. 11, 1871) \$5, 000. 00
 June 10, 1872 (allotment July 11, 1872) 5, 000. 00
 Mar. 3, 1873 (allotment May 17, 1873) 5, 000. 00
 June 23, 1874 (allotment July 29, 1874) 5, 000. 00
 Mar. 3, 1875 (allotment Mar. 22, 1875) 5, 000. 00

¹ The custody and care of the gauges maintained under this appropriation were assumed by the Mississippi River Commission Feb. 11, 1901, on which date they were transferred to the secretary under authority of Secretary of War, dated Jan. 25, 1901.

² The amount, \$1,630.65, reported in annual report for 1916, has been increased \$1.05 by the secretary by refundments for overpayments, as follows:
 October, 1916, voucher 124, March, 1916 (reverted to Treasury) \$0. 40
 February, 1917, voucher 32, April, 1916 (reverted to Treasury) . 65

Specific appropriations by river and harbor acts of—	
Aug. 14, 1876	\$5,000.00
June 18, 1878	5,000.00
Mar. 3, 1879	5,000.00
June 14, 1880	5,000.00
Mar. 3, 1881	5,000.00
Aug. 2, 1882	5,000.00
Deficiency act of Mar. 12, 1884	2,100.00
Specific appropriations by river and harbor acts of—	
July 5, 1884	5,000.00
Aug. 5, 1886	5,000.00
Allotted from specific appropriation by river and harbor act of Aug. 11, 1888 (allotment Oct. 17, 1888)	
Deficiency act of Oct. 19, 1888	8,700.00
Allotments from permanent indefinite appropriation made by section 6 of river and harbor act of Aug. 11, 1888, for fiscal years, viz:	3,600.00
1890 (allotment Aug. 23, 1889)	9,000.00
1891 (allotment Aug. 19, 1890, \$8,700, less \$3,518.34 withheld in United States Treasury under ruling that only \$6,000 can be expended each fiscal year)	5,181.66
1892 (allotment July 17, 1891)	5,100.00
1893 (allotment July 15, 1892)	5,500.00
1894 (allotment July 18, 1893)	5,500.00
1895 (allotment June 5, 1894)	5,500.00
1896 (allotment June 4, 1895)	5,500.00
1897 (allotment May 13, 1896)	5,500.00
1898 (allotment June 16, 1897)	5,500.00
1899 (allotments May 27, 1898, \$5,500, July 12, 1898, \$500)	6,000.00
1900 (allotment June 1, 1899)	5,500.00
1901 (allotment July 2, 1900)	6,000.00
1902 (allotment July 31, 1901)	6,000.00
Allotments from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902, for fiscal years, viz:	
1903 (allotment July 23, 1902, \$9,600, less \$500 allotted Aug. 2, 1902, to St. Paul, Minn., district)	9,100.00
1904 (allotment Apr. 18, 1903)	9,100.00
1905 (allotment Aug. 11, 1904)	9,100.00
1906 (allotment June 30, 1905)	9,100.00
1907 (allotment July 2, 1906)	9,100.00
1908 (allotment July 24, 1907)	9,100.00
1909 (allotment July 3, 1908)	9,100.00
1910 (allotment July 13, 1909)	9,100.00
1911 (allotment July 27, 1910)	9,600.00
1912 (allotment Feb. 7, 1911)	9,100.00
1913 (allotment May 29, 1912)	9,100.00
1914	9,100.00
1915 (allotment Sept. 2, 1914)	9,100.00
1916 (allotment July 28, 1915)	9,100.00
1917 (allotment Aug. 3, 1916)	9,100.00
Total	292,181.66

Expended.

	To June 30, 1916.	During year ending June 30, 1917.	Total.
Expenditures.....	¹ \$263,997.11	\$8,313.92	\$272,312.08
Unexpended balances reverted to Treasury.....	17,452.85	646.09	18,097.89
Total.....	281,449.96	8,960.01	290,409.97
Unexpended balance June 30, 1917.....			1,771.69
Total appropriated, etc.....			292,181.66

¹ The amount, \$263,998.16, reported in annual report for 1916, has been decreased \$1.05, by refundments of overpayments, by the secretary, as follows:

October, 1916, voucher 124, March, 1916 (reverted to Treasury).....	\$0.40
February, 1916, voucher 32, April, 1916 (reverted to Treasury).....	.65

1.05

APPROPRIATION FOR WATERWAY FROM LOCKPORT, ILL., TO ST. LOUIS, MO.

Act of June 13, 1902 (river and harbor).....	\$25,000.00
Amount transferred from allotment for "Survey of Illinois and Des Plaines Rivers, Ill.," as reimbursement.....	1,093.40
Total.....	26,093.40
Expended to June 30, 1906.....	\$22,291.23
Unexpended balance carried to surplus fund on June 30, 1909, under the provisions of section 10 of sundry civil act of Mar. 4, 1909.....	3,802.17
	26,093.40

APPROPRIATION FOR CLAIMS FOR DAMAGES BY COLLISION, RIVER AND HARBOR WORKS.

Act of Apr. 6, 1914 (urgent deficiency).....	\$58.84
Expended in fiscal year 1914.....	58.84
Act of Sept. 8, 1916 (general deficiency).....	427.30
Expended in fiscal year 1917.....	427.30

Contractor.	Amount and character of work.	Price.	Date of contract.	Date of approval.	Date of beginning work.	Date of expiration.	Percentage of completion.
Cameron, Joyce & Co.	88,000 cubic yards levee work in Hunt drainage district, Ill.	22½ cents per cubic yard.	Sept. 22, 1914	Oct. 15, 1914	Oct. 27, 1914	Dec. 31, 1915	98.9
Combustion Engineering Corporation	Mechanical stokers on dredge B. M. Harrod.	\$9,150	Apr. 7, 1916	May 3, 1916	May 16, 1916	Oct. 12, 1916	93.0
International Building Co.	Mechanical stokers on dredge Henry Flad.	\$6,850.	June 29, 1916	Emergency	July 1, 1916	June 31, 1917	100
Southwestern Telegraph & Telephone Co.	Lease of offices and storage rooms.	\$6,724 per annum.	July 1, 1916	do.	do.	do.	100
	Telephone service.	\$96 per annum.					
	Two extension telephone desk sets.	\$36 per annum.					
	Cut-out switch.	\$2 per annum.					
	Telephone service.	\$78 per annum.	July 3, 1916	do.	do.	do.	100
Cumberland Telephone & Telegraph Co.							
Lloyd W. Lang, trustee	Lease of water-front privileges.	\$150 per annum.	Aug. 23, 1916	do.	do.	do.	100
Roach & Stansell	100,000 cubic yards levee work in East Cape Girardeau and Clear Creek drainage district, Ill.	15.33 cents per cubic yard.	Dec. 29, 1916	Jan. 25, 1917	Feb. 2, 1917	Dec. 31, 1917	51.8
Hillboro Dredging Co.	49,000 cubic yards levee work in East Side levee and sanitary district, Ill.	35½ cents per cubic yard.	Jan. 17, 1917	Feb. 12, 1917	Feb. 19, 1917	do.	17
A. Hoen & Co.	31,500 detail charts.	\$18 per 100.	do.	Feb. 7, 1917	Feb. 14, 1917	Aug. 14, 1917	8
	3,000 detail charts.	\$35 per 100.					
	11,500 inch-mile maps.	\$10 per 100.					
	650 inch-mile maps.	\$12 per 100.					
Chas. W. Hunter	Lease of water-front privileges.	\$100 per annum.	Mar. 15, 1917	Emergency	Mar. 1, 1917	June 31, 1917	100
West Kentucky Coal Co.	3,500 tons screened lump coal.	\$4.05 per ton.	do.	May 4, 1917	May 10, 1917	June 31, 1918	
	6,250 tons mine-run coal.	\$3.25 per ton.					
	4,600 tons pea and slack coal.	\$3.20 per ton.					
Fred C. Morgan	110,000 cubic yards levee work in River-land levee district, Mo.	16 cents per cubic yard.	May 11, 1917	May 31, 1917	June 11, 1917	Dec. 31, 1917	21.2

¹ Time limit waived.

TABLE No. 1.—*Commercial statistics for calendar year 1916.*

Tonnage between	Number of passengers.	Receipts and shipments in tons.					
		Grain and its products.	Cotton.	Cotton seed and its products.	Live stock.	Coal and coke.	Lumber.
St. Louis and Cairo ¹	101, 131	13, 044	285	1, 027	6, 580	62, 723	19, 358
Cairo and Memphis ²	166, 886	7, 112	25, 896	4, 798	2, 506	477, 829	26, 795
Memphis and Vicksburg ³	150, 085	13, 175	30, 565	15, 338	10, 563	379, 201	32, 127
Vicksburg and New Orleans ⁴	38, 287	13, 239	6, 053	8, 324	3, 331	349, 394	70, 812

Tonnage between—	Receipts and shipments in tons.						
	Logs.	Iron, steel, and metals.	Groceries and provisions.	Stone, gravel, and sand.	Oil.	Unclassified and miscellaneous.	Total.
St. Louis and Cairo ¹	82, 854	4, 468	9, 061	771, 753	19, 569	75, 051	1, 065, 773
Cairo and Memphis ²	184, 270	313	11, 575	429, 779	1, 054	33, 720	1, 205, 647
Memphis and Vicksburg ³	155, 034	4, 206	20, 984	1, 059, 150	2, 395	87, 239	1, 809, 977
Vicksburg and New Orleans ⁴	77, 626	2, 185	75, 268	290, 457	1, 201, 581	135, 968	2, 234, 238

¹ Includes 12,752 tons coal, 196 tons groceries, 52,211 tons stone, and 5,490 tons miscellaneous handled by Government vessels.

² Includes 26,295 tons stone handled by Government vessels.

³ Includes 100 tons grain, 160 tons live stock, 9,500 tons coal, 150 tons lumber, 545 tons iron, 450 tons groceries, 69,854 tons stone, and 52,300 tons miscellaneous handled by Government vessels.

⁴ Includes 4,186 tons coal, 7,365 tons lumber, 228 tons iron, 64,372 tons stone, and 68,200 tons miscellaneous handled by Government vessels.

NOTE.—Each stretch is treated as a separate river, and tonnage carried between ports on different stretches will appear in the statistics of all intervening stretches; consequently the sum of the tonnage carried in the four stretches does not represent the total traffic on the river as a whole.

TABLE No. 2.—*Receipts and shipments at principal ports.*

Port.	Passengers carried in and out of port.	Receipts and shipments in tons.					
		Grain and its products.	Cotton.	Cotton seed and its products.	Live stock.	Coal and coke.	Lumber.
St. Louis, Mo. ¹	375, 837	12, 224	285	967	12, 903	68, 219	8, 204
Memphis, Tenn. ²	127, 637	14, 727	25, 897	8, 547	6, 260	138, 326	3, 148
Vicksburg, Miss. ³	13, 340	2, 224	1, 256	4, 019	740	278, 677	1, 674
New Orleans, La. ⁴	48, 369	948, 963	369, 802	149, 952	23, 641	307, 296	88, 927

Port.	Receipts and shipments in tons—Continued.						
	Logs.	Iron, steel, and metals.	Groceries and provisions.	Stone, gravel, and sand.	Oil.	Unclassified and miscellaneous.	Total.
St. Louis, Mo. ¹	11, 200	5, 943	31, 491	623, 622	8, 394	116, 291	899, 743
Memphis, Tenn. ²	77, 933	2, 255	14, 962	362, 966	428	22, 776	678, 255
Vicksburg, Miss. ³.....	.....	.....	7, 214	14, 373	600	9, 345	320, 122
New Orleans, La. ⁴	407, 653	50, 540	1, 739, 786	44, 671	2, 236, 721	1, 717, 991	8, 085, 943

¹ Includes 301,096 passengers in local excursion traffic; also 12,752 tons coal, 196 tons of groceries, and 1,138 tons miscellaneous, handled by Government vessels.

² Includes 200 tons lumber, 21 tons iron, 485 tons groceries, 49 tons oil, and 37 tons miscellaneous, handled by Government vessels.

³ Includes 412 tons coal, 816 tons lumber, 14,373 tons stone, and 4,000 tons miscellaneous, handled by Government vessels; the traffic with the Yazoo River and its tributaries not included.

⁴ Includes exports and imports, and the domestic coastwise traffic as far as reported; also 1,053 tons coal, 228 tons iron, and 8,880 tons gravel, handled by Government vessels.

TABLE No. 3.—*Seagoing traffic at New Orleans, La.*

Arrivals and departures.	Number.	Tonnage.	Passengers.
Foreign-bound vessels.....	2,916	5,550,306	21,346
Coastwise vessels.....	749	1,865,250	20,397
Total.....	3,665	7,415,556	41,743

Receipts and shipments.

	Tons.
Grain and its products.....	940,301
Cotton.....	363,252
Cotton seed and its products.....	145,707
Live stock.....	21,240
Coal and coke.....	34,815
Lumber.....	85,121
Logs.....	398,653
Iron, steel, and metals.....	48,787
Groceries and provisions.....	1,671,877
Oils.....	2,229,711
Stone, gravel, and sand.....	5,735
Miscellaneous and unclassified.....	1,670,410
Total.....	7,615,609

TABLE No. 4.—*Ferry traffic*

Location of ferries and transfers.	Number of passengers.	Tonnage of freight carried.					
		Grain and its products.	Cotton.	Cotton seed and its products.	Live stock.	Coal and coke.	Lumber.
At St. Louis, Mo.	418,255	144,000	120	.....	7,614	1,932,000	360,000
At Chester, Ill.; Little Rock, Mo.; Commerce, Mo.; and Cape Girardeau, Mo.	59,715	804	.....	.....	482	687,199	339
At Cairo, Ill., to Birds Point, Mo., Greenfield, Mo., and Wickliffe, Ky.; at Cottonwood Point, Mo., and Hales Point, Tenn.	194,023	6	36	5	547	.....	2
At Memphis, Tenn., to Hopefield, Ark., Mound City, Ark., and West Memphis, Ark.	135,089	510	2,354	2,055	164	15	229
At Helena, Ark., to Trotters Point, Miss., and Arkansas City, Ark.	125,287	24,990	3,678	19,951	1,212	123,017	53,460
At Vicksburg, Miss., to Delta Point, La.	119,378	4,627	1,204	201	1,826	63,621	6,004
At Natchez, Miss.; Vidalia, La.; Ango'a, La.; Naples, La.; Baton Rouge, La.; Anchorage, La.; St. Joseph, La.; Harts Landing, Miss.; Plaquemine, La.	192,779	301,705	57,011	7,733	4,938	106,203	155,999
At New Orleans, La.	5,836,915	205,631	81,380	13,553	10,519	163,654	262,772

Location of ferries and transfers.	Tonnage of freight carried.						
	Logs.	Iron, steel, and metals.	Groceries and provisions.	Stone, gravel, and sand.	Oil.	Unclassified and miscellaneous.	Total tonnage.
At St. Louis, Mo.	.....	49,825	22,871	52,600	12,775	553,852	3,135,657
At Chester, Ill.; Little Rock, Mo.; Commerce, Mo.; and Cape Girardeau, Mo.	3,055	173	150	11,647	41	536,124	1,240,014
At Cairo, Ill., to Birds Point, Mo., Greenfield, Mo., and Wickliffe, Ky.; at Cottonwood, Point, Mo., and Hales Point, Tenn.	.....	.....	64	.....	2	16,424	17,086
At Memphis, Tenn., to Hopefield, Ark., Mound City, Ark., and West Memphis, Ark.	.....	45	650	.....	65	8,048	14,145
At Helena, Ark., to Trotters Point, Miss., and Arkansas City, Ark.	4,996	12,186	73,937	1,122	13,580	11,830	344,589
At Vicksburg, Miss., to Delta Point, La.	.....	29,987	9,274	711	1,384	589,648	708,487
At Natchez, Miss.; Vidalia, La.; Ango'a, La.; Naples, La.; Baton Rouge, La.; Anchorage, La.; St. Joseph, La.; Harts Landing, Miss.; Plaquemine, La.	5,117	19,803	58,810	65,325	247,212	344,010	1,373,866
At New Orleans, La.	.....	155,278	.....	8,159	61,337	2,502,704	3,464,987

Transfer of empty cars not included in tonnage at rail'road transfer points.

Owing to deficiency and inaccessibility of the records of some transportation companies, considerable tonnage, which should appear under classified heads above, had to be included in "Unclassified and miscellaneous."

Statement of maps and charts issued and sold from July 1, 1916, to June 30, 1917, improving Mississippi River, Mississippi River Commission, secretary's office.

Description.	Free issue.	Sold.	Total.
Sheets, Mississippi River, scale 1:20000.....	471	405	876
Sheets, Mississippi River, scale 1:10000.....	78	31	109
Sheets, lower Mississippi River, scale 1 inch = 1 mile.....	383	509	892
Sheets, upper Mississippi River, scale 1 inch = 1 mile.....	57	385	442
Sets, upper alluvial valley (4 sheets each).....	2	13	15
Sheets, upper alluvial valley.....	1	3	4
Sets, lower alluvial valley (8 sheets each), 1913 edition.....	7	19	26
Sheets, lower alluvial valley, 1913 edition.....	6	1	7
Sets, lower alluvial valley (8 sheets each), 1887 edition.....	2	7	9
Sheets, lower alluvial valley, 1887 edition.....	.....	2	2
Sets, harbor New Orleans, scale 1:10000 (4 sheets each).....	1	5	6
Sheets, district map of lower Mississippi River.....	8	6	14
Sheets, Lake Itasca Basin.....	1	.....	1
Sets, St. Francis Basin (2 sheets each).....	2	1	3
Sheets, St. Francis Basin.....	6	.....	6
Total.....	1,025	1,387	2,412

Proceeds deposited to the credit of the Treasurer of the United States, \$251.02.

TABLE No. 1.—Highest and lowest gauge readings of 1916.

MISSISSIPPI RIVER.

Station.	Distance from Cairo.	Elevation of gauge zero above mean Gulf level.	Highest.			Lowest.				
			Prior to 1916.		1916	Prior to 1916.		1916		
			Date.	Gauge reading.	Date.	Gauge reading.	Date.	Gauge reading.		
<i>Miles above.</i>		<i>Fect.</i>	<i>Fect.</i>		<i>Fect.</i>		<i>Fect.</i>		Difference compared with previous lowest.	
1,090		1,866.35	July 6-8, 1905.	16.36	Apr. 29, 30.	Apr. 8, 9, 1911.	0.75	Nov. 16.	3.25	+ 2.50
874		684.24	Apr. 29, 1881.	18.7	Apr. 6, 9.	Dec. 7, 1912.	-1.0	Nov. 23.	1.7	+ 2.70
849		670.36	Apr. 30, 1881.	18.0	Apr. 8.	Nov. 23, 1892.	-1.7	Dec. 14.	2.0	+ 2.70
760		639.90	June 18, 1880.	16.87	Apr. 27.	Dec. 30, 1889.	-1.33	Dec. 15.	2.3	+ 3.63
668		605.16	June 22, 1880.	21.30	May 1.	do.	-1.30	Dec. 9-11.	3.6	+ 3.70
510.7		541.94	June 27, 1892.	19.4	May 5.	Dec. 5, 1910.	-1.15	Dec. 15.	2.3	+ 3.45
427.6		510.82	May 18, 1918.	17.6	May 9.	Dec. 10, 1910.	-1.25	Dec. 24.	3.42	+ 5.45
			June 30, 1892.	17.6						
406.5		502.23	June 6, 1851.	21.40	Feb. 1, 3. May 9, 10.	1895.	4 - 3	Dec. 24, 25.	12.0	+ 12.3
393.6		496.43	May 17, 18, 1888.	12.0			- 5			
385.2		477.35	June 6, 1851.	20.96	May 14.	Jan. 7, 1890.	-2.1	Dec. 17.	1.0	+ 3.1
329.4		448.97	June 8, 1903.	22.5	May 16.	Dec. 14, 1910.	-1.80	Dec. 21.	.9	+ 2.70
233		403.66	June 11, 1903.	28.7	Jan. 31, Feb. 1.	Dec. 9, 1895.	- 9	Dec. 25.	2.0	+ 2.9
						Dec. 19, 1897.	82.70	Dec. 23.	83.80	+ 1.10
216.2		313.54	June 9, 1903.	7115.80	Jan. 31.	Jan. 28, 29, 1902.	-2.52	do.	-2.20	+ .32
190.8		379.79	June 10, 1903.	38.0	Jan. 31, Feb. 1.	Jan. 2, 1900.	-4.0	Dec. 24.	-1.67	+ 2.97
115.5		340.87	June 13, 1903.	33.4	Feb. 2.	Jan. 3, 1900.	1.1	do.	4.6	+ 3.5
85		321.74	June 14, 1903.	33.80	Feb. 3.	Feb. 1, 1895.	6	do.	4.6	+ 4.0
54.5		304.54	do.	36.53	do.	Jan. 15, 1909.	2	Dec. 24, 25.	1.40	+ 1.20
48		300.85	June 14, 15, 1903.	36.0	do.	do.	-1.0	do.	5.80	+ 6.80
			Apr. 7, 1913.	54.69	Feb. 4.	Dec. 24, 1871.	05	do.	6.30	+ 6.25
270.41		270.41								
<i>Below.</i>										
21.6		266.46	Apr. 8, 1913.	49.30	Feb. 5.	Nov. 6-8, 1895.	- 17	do.	4.20	+ 3.65
69		256.04	Feb. 24, 1884.	41.50	Feb. 5, 6.	Nov. 5-8, 1895.	55	Dec. 26.	3.3	+ 3.65
70.3		255.96	Apr. 9, 1913.	44.61	Feb. 7, 8.	Nov. 7, 8, 1895.	-3.35	do.	2.80	+ 2.04
122.5		230.50	Apr. 11, 12, 1913.	42.30	Feb. 9.	Nov. 6-9, 1895.	16	Dec. 27.	2.2	+ 5.45
175.4		208.74	Apr. 9, 1913.	44.07	Feb. 10.	Nov. 8-11, 1895.	-2.65	Dec. 28.	3.10	+ 7.70
230		184.21	do.	46.55	Feb. 11, 12.	Nov. 12-14, 1895.	-3.00	do.	4.05	+ 5.55
276.3		161.35	Apr. 10, 1913.	43.28	Feb. 10.		-1.50	Dec. 28.		
306.5		141.81	Apr. 22, 1913.	55.20	Feb. 10.					
352.7		127.25	do.	51.27	Feb. 10.					

Month White River, Ark.	393.2	103.86	Apr. 16, 1912.....	56.35	.....do.	56.50	+	.15	Dec. 28, 1872.....	.00	.....do.	9.15	+	9.15
Arkansas City, Ark.....	438.3	96.75	Apr. 12, 1912.....	55.33	Feb. 10, 11.....	56.4	+	1.07	Nov. 9, 10, 1895.....	-3.6	Dec. 29.....	6.0	+	9.6
Greenville, Miss.....	478.3	88.53	do.....	50.76	Feb. 11-14.....	50.75	-	.01	Nov. 10, 11, 1895.....	-2.55	do.....	3.35	+	5.90
Lake Providence, La.....	542.3	69.77	do.....	48.25	Feb. 15.....	48.80	+	.55	Nov. 17, 1895.....	-5.30	Dec. 30.....	2.65	+	7.95
Vicksburg, Miss.....	599.3	66.16	do.....	52.48	do.....	53.85	+	1.37	Nov. 13, 14, 1895.....	-6.5	Dec. 30, 31.....	4.20	+	10.70
St. Joseph, La.....	648.3	33.15	Apr. 26, 1913.....	49.48	do.....	50.80	+	1.32	Nov. 13, 1895.....	-9.3	Nov. 22.....	1.10	+	8.20
Natchez, Miss.....	700.3	17.09	Apr. 27, 1913.....	52.6	do.....	53.5	+	.9	Nov. 13, 15, 1895.....	-85	do.....	6.54	+	7.39
Red River Landing, La.....	765.3	3.57	May 11, 12, 1912.....	53.20	Mar. 2, 3.....	52.45	-	.75	Nov. 14, 1895.....	-60	Oct. 30.....	5.38	+	5.98
Baton Rouge, La.....	799.3	3.87	May 11, 1912.....	47.37	Mar. 2.....	46.08	-	1.29	Nov. 16, 1895.....	-2.8	Oct. 27, Nov. 2, 3.....	7	+	3.5
Baton Rouge, La.....	833.3	-42	do.....	43.82	Mar. 1, 2.....	42.57	-	1.25	Nov. 14, 1894.....	.45	Oct. 27, Nov. 29.....	3.10	+	2.65
Plaquemine, La.....	854.1	-18	do.....	39.38	Mar. 1.....	38.80	-	.58	do.....	-.04	Oct. 29.....	1.50	+	2.44
Donaldsonville, La.....	885.4	-1.01	May 10, 1912.....	35.1	Feb. 29-Mar. 4.....	34.0	-	1.1	Nov. 11, 1894.....	1.00	Dec. 15.....	2.2	+	1.20
College Point, La.....	904.5	.29	May 11, 1912.....	30.18	Mar. 3, 4.....	23.45	-	.73	Nov. 14, 1894.....	-.91	do.....	.35	+	1.26
Carrollton, La.....	957	-.13	do.....	21.65	do.....	20.05	-	1.00	Dec. 27, 1872.....	-1.00	Dec. 12.....	.10	+	1.70
Algiers, La.....	968	-2.04	do.....	20.8	Feb. 28, 29.....	20.1	-	.7	Dec. 6, 1910.....	1.95	Dec. 12, 15.....	2.7	+	1.75
Fort Jackson, La.....	1,039	-1.68	May 8, 1913.....	8.30	Mar. 1.....	8.8	+	.5	Dec. 7, 1893.....	.3	Dec. 24, 25.....	1.2	+	.9
			{Sept. 29, 1915.....	12 9.1										

NOTE.—High waters prior to 1880 are usually from old H. W. marks.

¹ H. W. of 1870 would read 18.76 feet.

² H. W. of 1881 would read 18.94 feet.

³ Keokuk dam effective after May, 1913.

⁴ Lowest reading during navigable season. The low water is now affected by dam and reads about 9.5 feet on gage.

⁵ The gage was drowned out by backwater of Keokuk dam and readings discontinued after May 31, 1913.

⁶ H. W. of June, 1844, would read 32.1 feet.

⁷ H. W. of 1844 would read 118.94 feet.

⁸ H. W. of June 28, 1844, would read 41.39 feet.

⁹ H. W. of July 4, 1844, would read 42.53 feet.

¹⁰ H. W. of July 4, 1844, would read 47.56 feet.

¹¹ Gage transferred to New Madrid in 1893.

¹² Due to storm.

TABLE No. 1.—*Highest and lowest gauge readings, 1916*—Continued.
 TRIBUTARIES OF MISSISSIPPI RIVER AND THE ATCHAFALAYA.

River.	Station.	Eleva- tion of gauge zero above mean Gulf level.	Highest.				Lowest.												
			Prior to 1916.		1916.		Prior to 1916.		1916.										
			Date.	Gauge read- ing.	Date.	Gauge read- ing.	Date.	Gauge read- ing.	Date.	Gauge read- ing.									
		<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>															
Arkansas.	Little Rock, Ark.	174	222.06	May 21, 1892.	31.20	Feb. 2.....	28.80	Sept. 9, 1913.....	— 0.20	Nov. 17-21.....	0.7	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Pine Bluff, Ark.	108	180.78	May 22, 1892.	30.55	Feb. 3.....	29.6	Nov. 20-23, 1887.....	— .40	Nov. 15-22.....	3.2								
	Do.	108	181.78	May 11-15, 1912.	53.55	Mar. 3, 4.....	52.00	Oct. 26, 1897.....	— 1.77	Nov. 28.....	3.90								
	Atchafalaya.	0	3.88																
Do.	Simmesport, La. 1.	5	5.79	May 13, 1912.	50.14	Mar. 1-6.....	48.5	Nov. 8, 1891.....	— 3.5	Nov. 29, 30.....	6.6	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Do.	31	0.44	May 6-15, 1912.	41.73	Feb. 14.....	43.0	Nov. 12, 13, 1894.....	1.0	Nov. 29, 30.....	6.6								
	Nashville, Tenn.	246	356.17	Jan. 22, 1882.	55.30	Jan. 5.....	42.40	Oct. 15, 16, 1878.....	— .40	Oct. 16.....	7.13								
	Peoria, Ill.	160	428.52	Mar. 28, 29, 1904.	23.00	Jan. 25.....	23.1	Aug. 3, Sept. 1, 1873; Aug. 5-12, 1874; Jan. 19-26, 1875.	.00	Sept. 27, 28, Oct. 3-5.	9.6								
Do.	Beardstown, Ill.	86	419.87	Feb. 25, 1893; Apr. 5, 6, 1913.	21.80	Feb. 1, 2.....	20.7	Sept. 18, 19, 1879.....	— .3	Sept. 28, Oct. 2-19.	8.1	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Kansas City, Mo.	338	716.93	June 1, 2, 1913.	435.0	July 15.....	19.8	Dec. 5-9, 1886; Jan. 8, 1891.	.2	Dec. 20.....	2.5								
	Coles Creek, Mo. 6.	107	413.54	May 15, 1892.	93.76	June 9.....	21.1	Dec. 24, 1897.....	70.7	Dec. 27.....	1.1								
	Hermann, Mo.	103	481.74	June 6, 1903.	29.5	June 9.....	21.1	Dec. 21, 22, 1878.....	— .75	Dec. 27.....	1.1								
Ohio.	St. Charles, Mo.	28	413.53	June 8, 1903.	33.95	do.....	24.80	Dec. 26, 1879.....	— 3.53	Dec. 24, 25.....	5.45	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Pittsburgh, Pa.	966	697.2	Mar. 15, 1907.	35.5	Mar. 29.....	21.8	Sept. 28, 1881.....	— 1.8	May 11.....	9.25								
	Cincinnati, Ohio.	498	429.25	Feb. 14, 1884.	71.06	Apr. 1.....	53.5	do.....	1.92	Oct. 31.....	37.8								
	Do.	364	402.53	Feb. 16, 1884.	46.60	Jan. 15.....	31.2	1886.....	1.1	Dec. 19.....	5.4								
Do.	Louisville (upper), Ky.	384	375.39	do.....	72.00	do.....	56.8	do.....	1.0	Oct. 2.....	3.7	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Louisville (lower), Ky.	384	375.39	do.....	72.00	do.....	56.8	do.....	1.0	Oct. 2.....	3.7								
	Evansville, Ind.	179	229.26	Feb. 19, 1884.	48.8	Jan. 18.....	43.6	Nov. 7, 8, 1895.....	— .3	Oct. 20, 21.....	3.3								
	Paducah, Ky.	43	286.18	Apr. 7, 1913.	54.3	Jan. 18, 19.....	45.7	Oct. 31-Nov. 4, 1895.	— .7	Nov. 17-22.....	2.1								
Do.	Cairo.	179	286.18	Apr. 7, 1913.	54.3	Jan. 18, 19.....	45.7	Oct. 31-Nov. 4, 1895.	— .7	Nov. 17-22.....	2.1	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Cairo.	179	286.18	Apr. 7, 1913.	54.3	Jan. 18, 19.....	45.7	Oct. 31-Nov. 4, 1895.	— .7	Nov. 17-22.....	2.1								
	Cairo.	179	286.18	Apr. 7, 1913.	54.3	Jan. 18, 19.....	45.7	Oct. 31-Nov. 4, 1895.	— .7	Nov. 17-22.....	2.1								
	Cairo.	179	286.18	Apr. 7, 1913.	54.3	Jan. 18, 19.....	45.7	Oct. 31-Nov. 4, 1895.	— .7	Nov. 17-22.....	2.1								
Do.	Cairo, Ill.	0	270.41	do.....	54.69	Feb. 4.....	53.21	Dec. 24, 1871.....	— 1.00	Dec. 25.....	5.80	<i>Feet.</i>	Differ- ence com- pared with pre- vious low- est.	Differ- ence com- pared with pre- vious low- est.					
	Camden, Ark.	114	357.17	May 12, 1882.	46.0	Feb. 1.....	39.0	Aug. 29, 31, 1887.....	1.80	Oct. 12-17.....	3.1								
	Do.	114	357.17	May 12, 1882.	46.0	Feb. 1.....	39.0	Aug. 29, 31, 1887.....	1.80	Oct. 12-17.....	3.1								
	Monroe, La.	217	30.90	1874.....	49.1	Feb. 19, 20.....	40.6	Sept. 13-20, 1909.....	— 1.8	Aug. 4.....	5.7								

Red.	Fulton, Ark.	Month ¹⁰	492	224.48	July 17, 1876.	35.75	Feb. 4.	31.95	- 3.80	Sept. 20-25; Oct. 20-22, 1896.	.10	Nov. 19-21.	5.00	+4.90
Do.	Garland, Ark. ⁶	Month.	424	203.16	Mar. 24, 1894.	28.50	Feb. 10.	25.5	-10.40	Sept. 22-25, 1896.	-.20	Oct. 13.	5.5	..00
Do.	Shreveport, La.	Month.	305	140.99	August, 18-9.	35.90	Feb. 16.	36.89	-4.95	Dec. 2-4, 1894.	-5.50	Oct. 16, 17.	1.90	+5.60
Do.	Alexandria, La.	Month.	118	44.18	July 6, 19-8.	41.84	Feb. 10.	36.89	-12.0	Sept. 29, 1881.	-3.7	Oct. 17, 18, Nov. 1-20.	1.1	+1.15
St. Francis.	Bridge St. L. I. M. & S. R.	Month.	100	176.5	Apr. 4-6, 1897	41.6	Feb. 9-12.	29.6	..	Nov. 3-11, 1901.	-.05	..	..	..
Do.	Wittsburg, Ark. ⁶	Month.	86	..	Apr. 28, 1886.	42.02	..	..	..	Oct. 27-31, Nov. 10-14, 1892.	-3.60	..	..	..
Tennessee.	Chattanooga, Tenn.	Cairo.	509	617.81	Mar. 11, 1867.	58.6	Jan. 1.	132.9	-25.7	Sept. 11-14, 1881.	.00	Aug. 30, 31.	6.8	+6.80
Do.	Florence, Ala.	Cairo.	301	400.85	Mar. 19, 1897.	32.20	July 12, 13.	20.46	-11.74	Sept. 19, 1883.	..	Oct. 1, 2, 14, 15, Nov. 14-16.	16	+ .92
Do.	Johnsonville, Tenn.	Cairo.	141	315.89	1882, Mar. 24, 1897.	48.0	Jan. 8.	32.5	-15.5	Sept. 18, 1878.	..	Nov. 16-20.	1.3	+2.2
Wabash.	Mount Carmel, Ill.	Cairo.	221	372.27	Mar. 30, 1913.	31.0	Feb. 6, 7.	26.5	-4.5	Nov. 7-23, 1895.	..	Oct. 11-18.	1.2	+1.4
White.	Jacksonport, Ark.	Month.	264	138.47	Aug. 23, 1915	33.96	Feb. 1.	33.90	-.06	Dec. 24, 1872.	-1.10	Oct. 31-Nov. 7.	.35	+1.45
Do.	Clarendon, Ark.	Month.	100	138.47	Mar. 20, 1890.	36.63	Feb. 7.	38.43	+1.80	Nov. 22, 1887.	4.07	Nov. 5.	6.28	+2.21
Yazoo.	Yazoo City, Miss.	Month.	65	73.61	1882.	36.50	Feb. 18.	29.9	-6.60	1875.	-4.30	Nov. 21, 22.	-2.0	+2.30

¹ Record from May, 1892 to December, 1905, in part only.

² Readings below 30 feet discontinued Jan. 16, 1915.

³ Low stage affected by dam.

⁴ H. W. of June, 1844 would read 37.0 feet.

⁵ Jan. 6, 1874, gauge read -0.1; probably affected by ice.

⁶ Discontinued.

⁷ H. W. of June, 1844, would read 35.6 feet.

⁸ H. W. of June, 1844, would read 39.57 feet.

⁹ Stages below 6 feet affected by Davis Island Dam.

¹⁰ Mouth of Red River is assumed to be at junction with Mississippi River.

¹¹ Stages affected by dam and power plant. See descriptive text.

TABLE No. 2.—*Highest gauge readings, Mississippi River and tributaries, in 1917 to June 30.*

[See Table No. 1 for previous highest known readings.]

River.	Station.	Date, 1917.	Gage readings.
			<i>Fect.</i>
Mississippi.....	St. Paul, Minn.....	Apr. 9.....	16.0
Do.....	Rock Island, Ill.....	Apr. 21-23.....	12.3
Do.....	Hannibal, Mo.....	June 9.....	18.1
Do.....	Grafton, Ill.....	June 14.....	22.9
Do.....	St. Louis, Mo.....	.....do.....	32.9
Do.....	Chester, Ill.....	June 15.....	30.7
Do.....	Grand Tower, Ill.....	June 16.....	33.4
Do.....	Cape Girardeau, Mo.....	.....do.....	34.2
Do.....	Cairo, Ill. (Ohio River).....	Apr. 4-5.....	49.95
Do.....	Columbus, Ky.....	Apr. 5.....	45.75
Do.....	New Madrid, Mo.....	Apr. 5-6.....	39.33
Do.....	Cottonwood Point, Mo.....	Apr. 7-8.....	37.45
Do.....	Fulton, Tenn.....	Apr. 9.....	37.1
Do.....	Memphis, Tenn.....	Apr. 10.....	40.47
Do.....	Mhoun Landing, Miss.....	Apr. 10-12.....	42.32
Do.....	Helena, Ark.....	Apr. 12-13.....	49.90
Do.....	Sunflower Landing, Miss.....	Apr. 13-14.....	47.45
Do.....	Mouth White River, Ark.....	Apr. 15-18.....	51.57
Do.....	Arkansas City, Ark.....	Apr. 17-18.....	52.1
Do.....	Greenville, Miss.....	Apr. 19-21.....	45.70
Do.....	Lake Providence, La.....	Apr. 20-21.....	44.70
Do.....	Vicksburg, Miss.....	Apr. 23.....	49.98
Do.....	St. Joseph, La.....	Apr. 22-25.....	46.80
Do.....	Natchez, Miss.....	Apr. 25-27.....	49.9
Do.....	Red River Landing, La.....	Apr. 28.....	47.62
Do.....	Bayou Sara, La.....	Apr. 24-May 1.....	40.6
Do.....	Baton Rouge, La.....	Apr. 29-May 2.....	37.87
Do.....	Plaquemine, La.....	Apr. 26.....	33.61
Do.....	Donaldsonville, La.....	Apr. 24-26, 29-May 2.....	29.52
Do.....	College Point, La.....	May 1.....	25.22
Do.....	Carrollton, La.....	May 2.....	16.9
Do.....	Fort Jackson, La.....	May 7.....	7.7
Arkansas.....	Little Rock, Ark.....	June 12.....	16.20
Atchafalaya.....	Barbro Landing, La.....	May 1.....	44.95
Do.....	Melville, La.....	Apr. 30-May 2.....	39.6
Cumberland.....	Nashville, Tenn.....	Mar. 10.....	45.70
Illinois.....	Peoria, Ill.....	June 16.....	18.20
Missouri.....	Kansas City, Mo.....	June 9.....	26.5
Do.....	Hermann, Mo.....	June 13.....	24.7
Do.....	St. Charles, Mo.....	June 14.....	28.95
Ohio.....	Pittsburgh, Pa.....	Jan. 23.....	24.0
Do.....	Cincinnati, Ohio.....	Mar. 17.....	56.0
Do.....	Louisville, Ky. (upper).....	Mar. 9.....	25.0
Do.....	Louisville, Ky. (lower).....	.....do.....	50.6
Do.....	Evansville, Ind.....	Mar. 22.....	42.9
Do.....	Paducah, Ky.....	Mar. 26.....	47.1
Ouachita.....	Camden, Ark.....	Mar. 8.....	31.7
Do.....	Monroe, La.....	Apr. 9.....	28.4
Red.....	Fulton, Ark.....	May 1.....	20.1
Do.....	Shreveport, La.....	May 4.....	10.4
Do.....	Alexandria, La.....	May 6.....	18.50
St. Francis.....	Bridge, St. Louis, Iron Mountain & South- ern Ry.....	Apr. 13-15.....	23.9
Tennessee.....	Chattanooga, Tenn.....	Mar. 8.....	47.4
Do.....	Florence, Ala.....	Mar. 12.....	24.70
Do.....	Johnsonville, Tenn.....	Mar. 18.....	38.8
Wabash.....	Mount Carmel, Ill.....	June 12.....	22.6
White.....	Jacksonport, Ark.....	Apr. 6.....	26.0
Do.....	Clarendon, Ark.....	Apr. 20.....	27.60
Yazoo.....	Yazoo City, Miss.....	Apr. 29.....	29.6

TABLE No. 3.—*Maximum heights above mean Gulf level at high-water and regular gauges on the Mississippi River from Cairo to the Passes during high water of 1917, with high waters of 1912 and 1913 for comparison.*

Designation of gauge.	Distance below Cairo. ¹	Highest water of 1917.		Highest water of 1912 (elevation above mean Gulf level).	Difference between highest of 1917 and 1912	Highest water of 1913 (elevation above mean Gulf level).	Difference between highest of 1917 and 1913.
		Date.	Elevation above mean Gulf level.				
	Miles.		Feet.	Feet.	Feet.	Feet.	Feet.
Cairo	0	Apr. 4, 5	320.4	324.4	-4.0	325.1	-4.7
182	4.1	do.	319.0	322.8	-3.8	323.3	-4.3
181	7.4	Apr. 5	317.7				
180	12.1	Apr. 4	316.1	319.4	-3.3	319.8	-3.7
179	16.9	do.	314.7	317.2	-2.5		
Columbus	21.8	Apr. 5	312.2	315.5	-3.3	315.8	-3.6
178	27.7	do.	309.7	313.1	-3.4	313.4	-3.7
177	33.0	do.	308.4	311.5	-3.1		
176	38.4	Apr. 6	305.0	307.9	-2.9		
175	44.9	do.	303.2	307.0	-3.8	307.4	-4.2
174	50.4	do.	300.9	304.7	-3.8	304.8	-3.9
173	55.3	do.	300.1	304.3	-4.2	303.8	-3.7
172	60.0	do.	299.3	303.0	-3.7	303.3	-4.0
171	66.2	do.	297.0			302.0	-5.0
New Madrid	71.1	Apr. 5, 6	295.3	300.1	-4.8	300.6	-5.3
170	76.0	Apr. 7	291.8	298.6	-6.8	299.1	-7.3
169	81.0	do.	289.5	295.4	-5.9	296.5	-7.0
168	85.2	Apr. 6, 7	287.9	291.6	-3.7	292.2	-4.3
167	91.3	Apr. 5-7	284.5	287.9	-3.4	288.6	-4.1
166	96.5	Apr. 6	280.9	285.5	-4.6	285.8	-4.9
165	100.9	Apr. 6, 7	278.9	283.1	-4.2	283.3	-4.4
164	105.5		276.4	281.9	-5.5	282.4	-6.0
163	110.4	Apr. 7, 8	274.7	280.0	-5.3	280.1	-5.4
162	115.6	Apr. 8	272.4	277.7	-5.3	278.0	-5.6
161	120.4	do.	269.6	274.4	-4.8	274.6	-5.0
Cottonwood Point	124.5	Apr. 7, 8	268.0	272.5	-4.5	272.8	-4.8
160	129.3	Apr. 8	265.3	271.3	-4.0	271.7	-6.4
159	132.9	Apr. 9	264.2	269.8	-5.6	269.9	-5.7
158	136.2	Apr. 8, 9	263.1	268.9	-5.8	268.8	-5.7
157	141.8	Apr. 10	261.0	266.6	-5.6	267.0	-6.0
156	148.2	Apr. 9, 10	257.6	263.9	-6.3	264.0	-6.4
155	154.7	Apr. 7-9	254.5	260.6	-6.1	261.3	-6.8
154	158.2	Apr. 9, 10	252.7	258.9	-6.2	259.5	-6.8
153	162.7	Apr. 9	250.9	257.7	-6.8	258.2	-7.3
152	168.8	Apr. 9, 10	248.7	255.5	-6.8	255.9	-7.2
151	172.7	Apr. 9	248.1	254.7	-6.6	254.7	-6.6
Bulton	175.4	do.	245.8	252.0	-6.2	252.8	-7.0
150	180.3	Apr. 10	243.8	249.8	-6.0	250.5	-6.7
149	184.6		241.3				
148	192.2	Apr. 9, 10	239.9	245.5	-5.6	246.0	-6.1
147	197.6	do.	237.8	243.2	-5.4	244.5	-6.7
146	204.7	do.	234.7	240.3	-5.6	241.5	-6.8
145	209.0		232.8	238.8	-6.0	239.8	-7.0
144	214.1		229.2				
113	218.7	Apr. 9, 10	227.7			235.6	-7.9
142	224.5	Apr. 8, 9	225.6				
Memphis	227.0	Apr. 10	224.7	229.4	-4.7	230.8	-6.1
141	232.0	Apr. 9, 10	221.9			227.0	-5.1
140	236.0						
139	238.7	Apr. 11	219.0	221.6	-2.6	222.9	-3.9
138	247.0		215.7	218.0	-2.3	218.9	-3.2
137	253.6	Apr. 10	213.0	214.2	-1.2	214.8	-1.8
136	258.7	Apr. 9-11	210.0				
135	264.0	do.	206.7	209.2	-2.5	209.6	-2.9
134	268.3	Apr. 10	205.7	207.5	-1.8		
Mhoon Landing	273.2	Apr. 10-12	203.7	206.2	-2.5	206.6	-2.9
133	277.9	Apr. 11, 12	202.4	205.4	-3.0	205.0	-2.6
132	281.5	Apr. 12, 13	200.9	203.2	-2.3	203.3	-2.4
131	288.1		198.8	202.0	-3.2	202.2	-3.4
130	291.4		198.2(?)	201.2	-3.0	201.7	-3.5
129	297.5	Apr. 12, 13	195.4	200.9	-5.5	200.6	-5.2
128	301.0	Apr. 13	193.7	198.6	-4.9	198.9	-5.2
Helena	307.1	Apr. 12, 13	191.7	196.1	-4.4	197.0	-5.3
127	314.0	do.	189.4	193.4	-4.0	195.0	-5.6
126	318.2	Apr. 13	187.3	191.8	-3.5	192.0	-4.7
125	324.9	do.	185.1	188.2	-3.1	189.8	-4.7
124	329.3			186.6		187.2	
123	333.8	Apr. 12	182.0	183.6	-1.6	185.0	-3.0
122	336.6	do.	180.0	182.0	-2.0		
121	343.1	Apr. 12, 13	178.0	180.8	-2.8	181.8	-3.8
120	347.1	Apr. 13	175.6	178.5	-2.9	179.6	-4.0

¹ Distances below Cairo are from the latest surveys.

TABLE NO. 3.—*Maximum heights above mean Gulf level at high-water and regular gauges on the Mississippi River, etc.*—Continued.

Designation of gauge.	Distance below Cairo. ¹	Highest water of 1917.		Highest water of 1912 (elevation above mean Gulf level).	Difference between highest of 1917 and 1912	Highest water of 1913 (elevation above mean Gulf level).	Difference between highest of 1917 and 1913.
		Date.	Elevation above mean Gulf level.				
	<i>Miles.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Sunflower Landing.....	353.7	Apr. 13, 14....	174.7	178.1	-3.4	178.5	-3.8
119.....	357.8	Apr. 14.....	172.6	176.5	-3.9	176.8	-4.2
118.....	362.8	do.....	171.2	175.1	-3.9	175.1	-3.9
117.....	366.5	Apr. 13.....	169.3	173.1	-3.8	173.0	-3.7
116.....	372.4	.....	167.4	.....	.....	170.6	-3.2
115.....	375.6	Apr. 14-16....	166.5	169.1	-2.6	168.2	-1.7
114.....	380.6	Apr. 14-17....	164.3	168.6	-4.3	167.8	-3.5
113.....	386.5	Apr. 15-18....	161.8	166.6	-4.8	165.7	-3.9
Mouth of White River.....	391.7	do.....	160.4	165.2	-4.8	164.2	-3.8
112.....	396.2	Apr. 16.....	158.9	163.8	-4.9	162.5	-3.6
111.....	399.2	Apr. 15-17....	158.2	162.4	-4.2	161.6	-3.4
110.....	405.0	.....	157.1	.....	.....	160.1	-3.0
109.....	408.4	.....	156.2	159.8	-3.6	.....	.....
108.....	413.9	Apr. 19.....	155.3	159.4	-4.1	158.8	-3.5
107.....	418.7	.....	157.0	.....	.....	156.7	.....
106.....	424.3	Apr. 15-18....	152.5	156.5	-4.0	156.5	-4.0
105.....	430.0	.....	150.4	153.7	-3.3	153.6	-3.2
Arkansas City.....	436.7	Apr. 17-18....	148.8	152.1	-3.3	151.9	-3.1
104.....	442.8	.....	146.7	149.6	-2.9	149.5	-2.8
103.....	448.7	Apr. 17-19....	145.3	148.6	-3.3	148.3	-3.0
102.....	453.0	.....	.....	.....	.....	.....	.....
101.....	460.2	Apr. 17.....	141.5	145.1	-3.6	144.7	-3.2
100.....	464.1	Apr. 20.....	140.5	144.0	-3.5	144.1	-3.6
99.....	467.5	Apr. 21.....	139.8	.....	.....	143.6	-3.8
98.....	476.1	Apr. 18-20....	136.7	.....	.....	141.2	-4.5
Greenville.....	482.2	Apr. 19-21....	134.2	139.3	-5.1	139.0	-4.8
97.....	484.2	Apr. 20, 21....	133.6	138.1	-4.5	137.9	-4.3
96.....	488.6	Apr. 21.....	132.6	137.0	-4.4	136.9	-4.3
95.....	490.9	.....	131.4	136.1	-4.7	135.7	-4.3
94.....	497.0	Apr. 19, 20....	129.2	133.8	-4.6	133.4	-4.2
93.....	502.6	.....	127.6	132.1	-4.5	132.0	-4.4
92.....	507.5	.....	126.1	130.5	-4.4	130.3	-4.2
91.....	512.1	Apr. 19-21....	123.7	127.6	-3.9	127.4	-3.7
90.....	516.9	Apr. 19-20....	122.7	126.2	-3.5	126.1	-3.4
89.....	522.9	Apr. 20.....	120.5	125.0	-4.5	124.6	-4.1
88.....	527.9	.....	119.2	122.8	-3.6	122.8	-3.0
87.....	532.6	Apr. 19.....	117.5	121.0	-3.5	120.6	-3.1
86.....	537.7	Apr. 19-21....	115.8	119.3	-3.5	118.8	-3.0
Lake Providence.....	542.0	Apr. 20, 21....	114.5	118.0	-3.5	117.8	-3.3
85.....	546.0	.....	113.8	.....	.....	.....	.....
84.....	551.3	Apr. 19-20....	112.1	114.6	-2.5	.....	.....
83.....	556.9	.....	109.8	113.0	-3.2	112.6	-2.8
82.....	560.8	.....	108.2(?)	.....	.....	110.5	-2.3
81.....	563.8	Apr. 19-21....	106.9	.....	.....	.....	.....
80.....	574.9	Apr. 20, 21....	103.8	105.6	-1.8	105.4	-1.6
79.....	579.3	do.....	102.4	104.5	-2.1	104.1	-1.7
78.....	585.1	.....	101.0	103.7	-2.7	103.3	-2.3
77.....	592.0	.....	98.8	101.0	-2.2	101.4	-2.6
76.....	596.0	Apr. 22-23....	97.9	.....	.....	.....	.....
Vicksburg.....	601.8	Apr. 23.....	96.1	97.8	-1.7	98.4	-2.3
75.....	606.3	Apr. 21-23....	95.0	96.3	-1.3	.....	.....
74.....	609.3	Apr. 21, 22....	93.4	94.5	-1.1	95.4	-2.0
73.....	617.6	Apr. 22-24....	91.8	92.2	-0.4	.....	.....
72.....	624.8	.....	90.1	91.8	-1.7	92.9	-2.8
71.....	631.7	Apr. 22-24....	88.4	88.8	-0.4	90.3	-1.9
70.....	639.8	.....	87.9	.....	.....	88.2	.....
69.....	646.0	Apr. 22, 23....	84.3	86.4	-2.1	87.4	-3.1
68.....	651.6	Apr. 23, 24....	82.8	84.5	-1.7	86.0	-3.2
67.....	657.2	Apr. 22-25....	81.3	83.0	-1.7	84.3	-3.0
St. Joseph.....	662.2	do.....	80.0	81.8	-1.8	82.6	-2.6
66.....	670.1	Apr. 21-26....	77.5	.....	.....	80.3	-2.8
65.....	675.2	.....	75.6	.....	.....	78.4	-2.8
64.....	678.7	Apr. 20.....	75.0	.....	.....	77.6	-2.6
63.....	683.1	.....	73.7(?)	76.0	-2.3	76.8	-3.1
62.....	687.4	.....	73.1(?)	.....	.....	75.3	-2.2
61.....	693.8	.....	.....	72.6	.....	73.9	.....
60.....	699.0	.....	69.4	71.4	-2.0	72.6	-3.2
Natchez.....	705.7	Apr. 25-27....	67.0	68.5	-1.5	69.7	-2.7
59.....	710.4	.....	65.7	67.3	-1.6	68.3	-2.6
58.....	716.9	Apr. 24-26....	64.1	66.3	-2.2	66.8	-2.7
57.....	720.9	Apr. 23-26....	63.6	66.0	-2.4	.....	.....

¹Distances below Cairo are from the latest surveys.

TABLE NO. 3. - *Maximum heights above mean Gulf level at high-water and regular gauges on the Mississippi River, etc.—Continued.*

Designation of gauge.	Distance below Cairo. ¹	Highest water of 1917.		Highest water of 1912 (elevation above mean Gulf level).	Difference between highest of 1917 and 1912	Highest water of 1913 (elevation above mean Gulf level).	Difference between highest of 1917 and 1913.
		Date.	Elevation above mean Gulf level.				
Natchez—Continued.	<i>Miles.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
56.....	726.4		61.9	64.8	-2.9		
55.....	732.2	Apr. 25.....	60.4	63.9	-3.5	64.0	-3.6
54.....	736.9	Apr. 26, 27.....	59.0	62.3	-3.3	61.9	-2.9
53.....	744.5		57.8	61.6	-3.8	60.9	-3.1
52.....	750.2	Apr. 27.....	56.6	60.6	-4.0	59.5	-2.9
51.....	754.5		55.4(?)	60.0	-4.6	57.8	-2.4
50.....	759.2	Apr. 27-30.....	54.1	59.1	-5.0	56.8	-2.7
49.....	763.1	Apr. 27-28.....	52.1	58.1	-6.0	55.2	-3.1
48.....	767.9	Apr. 25-29.....	51.8	57.9	-6.1		
Red River Landing.	772.6	Apr. 28.....	51.2	56.8	-5.6	54.1	-2.9
47.....	776.9	do.....	50.2	56.1	-5.9	53.3	-3.1
46.....	780.1	Apr. 27-29.....	49.9	55.6	-5.7	53.0	-3.1
45.....	784.4	Apr. 29.....	48.2	54.6	-6.4	51.9	-3.7
44.....	792.2	Apr. 25-30.....	47.5	54.0	-6.5	51.1	-3.6
43.....	797.6	Apr. 28-30.....	46.2	52.9	-6.7	50.0	-3.8
42.....	802.1	May 1.....	45.2	52.1	-6.9	49.2	-4.0
Bayou Sara.	806.9	Apr. 24-May 1.....	44.5	51.2	-6.7	48.4	-3.9
41.....	811.2	Apr. 28-29.....	43.6	49.7	-6.1	47.2	-3.6
40.....	814.9			49.2		46.7	
39.....	819.6	Apr. 26-28.....	42.1	48.1	-6.0	45.5	-3.4
38.....	824.9	Apr. 29-May 1.....	40.6	47.0	-6.4	44.3	-3.7
37.....	829.8	Apr. 29-May 2.....	39.9	46.0	-6.1	43.4	-3.5
36.....	835.6	May 1.....	38.0	44.1	-6.1	41.6	-3.6
Baton Rouge.	841.0	Apr. 29-May 2.....	37.4	43.4	-6.0	40.9	-3.5
35.....	846.8	Apr. 29.....	36.5	42.2	-5.7	39.8	-3.3
34.....	851.2	Apr. 24-28.....	35.2	41.1	-5.9	38.8	-3.6
33.....	857.4	Apr. 25-30.....	34.0	39.8	-5.8	37.5	-3.5
Plaquemine.	861.0	Apr. 26.....	33.8	39.6	-5.8	37.0	-3.2
32.....	867.0	Apr. 25-26.....	32.6	38.2	-5.6	35.8	-3.2
31.....	871.4	Apr. 29-May 1.....	31.8	37.2	-5.4	35.0	-3.2
30.....	876.7	Apr. 29.....	30.6	36.2	-5.6	33.9	-3.3
29.....	881.1	Apr. 25-30.....	30.0	35.7	-5.7	33.3	-3.3
28.....	886.2	Apr. 25.....	29.5	35.0	-5.5	32.7	-3.2
Donaldsonville.	892.8	Apr. 24-26, 29-May 2.....	28.5	34.1	-5.6	31.7	-3.2
27.....	896.4	Apr. 24-26.....	28.1	33.4	-5.3	31.2	-3.1
26.....	902.1	Apr. 26-30.....	27.0	32.4	-5.4	30.2	-3.2
25.....	906.9	Apr. 30-May 1.....	26.2	31.1	-4.9	29.1	-2.9
College Point.	910.6	May 1.....	25.5	30.5	-5.0	28.5	-3.0
24.....	918.0	Apr. 24, 26, 29.....	24.3	29.5	-5.2	26.9	-2.6
23.....	922.1	Apr. 24, 26, 28-May 2.....	23.8	28.5	-4.7	26.6	-2.8
22.....	926.9	Apr. 30, May 2.....	22.9	27.3	-4.4	25.5	-2.6
21.....	933.0	Apr. 23, 25, 27.....	21.1	25.6	-4.5	23.9	-2.8
20.....	937.6	Apr. 24-May 1.....	20.5	25.5	-5.0	23.1	-2.6
19.....	942.2	May 2.....	20.3	24.5	-4.2	22.8	-2.5
18.....	945.2		19.4	23.5	-4.1	22.2	-2.8
17.....	950.9		18.5	22.9	-4.5	21.3	-2.8
16.....	955.0	May 1.....	18.2	22.4	-4.2	20.8	-2.6
15.....	960.5	Apr. 29.....	17.3	21.0	-3.7	19.6	-2.3
Carrollton.	964.5	May 2.....	16.8	20.9	-4.1	19.2	-2.4
Algiers.	974.6	Apr. 28, 29.....	15.1	18.2	-3.1	17.0	-1.9
14.....	976.0	May 3-5.....	14.5	17.6	-3.1		
13.....	981.5	Apr. 25.....	13.5				
12.....	987.4		12.6				
11.....	991.9			14.9		14.8	-2.2
10.....	996.8	Apr. 29, 30.....	11.2	13.7	-2.5	13.9	-1.6
9.....	1,001.2			12.7		12.8	-1.6
8.....	1,007.1	May 3-5.....	9.8	12.2	-2.4	12.0	
7.....	1,011.9	Apr. 22-May 2, 3.....	9.9			11.4	-1.6
6.....	1,016.5	Apr. 28-May 5, 7.....	8.8	10.8	-2.0	10.2	-1.4
5.....	1,021.4	Apr. 28, 29.....	9.0				
4.....	1,026.8	May 4, 5.....	7.8	9.5	-1.7	8.8	-1.0
3.....	1,031.8	May 7.....	7.5				
2.....	1,036.6	May 5.....	7.0	8.6	-1.6	8.1	-1.1
1.....	1,041.7	do.....	6.1	7.3	-1.2	7.0	-0.9
Fort Jackson.	1,046.8	May 7.....	6.0	6.6	-0.6	6.6	-0.6
A.....	1,052.0	May 5.....	5.0	6.0	-1.0	5.7	-0.7
B.....	1,056.1	May 4, 5.....	4.8	5.2	-0.4	5.2	-0.4
C.....	1,062.6	May 7.....	4.7	4.7	0	4.5	+0.2

¹ Distances below Cairo are from the latest surveys.

TABLE No. 4.—Cost of dredging operations, May 1, 1916, to Apr. 30, 1917.

Class of work, or plant to which distributed.	Labor.	Office supplies.	Subsistence.	Fuel.	Lighting supplies.	Lubricants.
Care of plant.....	\$41,391.21	\$97.32	\$9,495.27	\$8,066.53	\$348.56	\$207.85
Repairs to floating plant:						
Dredge Beta.....	477.07		151.74		2.02	4.12
Dredge Gamma.....	1,964.62		485.98		8.02	61.34
Dredge Delta.....	95.80		32.65			.12
Dredge Epsilon.....	2,085.51		533.07		7.41	21.45
Dredge Zeta.....	466.42		113.05		3.26	8.69
Dredge Iota.....	2,431.17		643.05		11.17	217.24
Dredge Kappa.....	4,456.13		1,230.06		39.04	50.14
Dredge Henry Flad.....	6,353.88		1,616.37		35.90	124.05
Dredge B. M. Harrod.....	3,100.67	.13	841.39		28.65	12.92
Steamer Sachem.....	1,055.50		240.08		6.99	108.17
Steamer Choctaw.....	702.30	.66	177.01		2.30	13.02
Steamer Nokomis.....	167.62		39.60		.57	60.99
Steamer Wynoka.....	180.10		41.27			4.25
Steamer Leota.....	993.78		330.91		1.34	49.46
Steamer Inspector.....	1,749.50		461.84		12.95	47.48
Steamer Saturn.....	401.20		103.79		.19	27.36
Steamer Jupiter.....	893.05		239.49		15.37	42.48
Steamer Vulcan.....	390.20		83.12		6.02	31.66
Steamer Venus.....	651.76		153.38		4.60	9.75
Steamer Mars.....	1,168.82		263.99		4.88	9.24
Steamer Mercury.....	887.94	.33	186.79		.73	11.25
Pile sinker No. 13.....	68.76		21.46			1.30
Pile sinker No. 971.....	72.48		20.64			13.25
Pile sinker No. 981.....	226.43		38.30		.05	
Pile sinker No. 982.....	206.08		35.48			3.86
Pile sinker No. 983.....	97.19		26.50			3.71
Pump boat.....	18.08		4.08			
Barge No. 041.....	21.37		3.38			
Barge No. 051.....	184.00		41.14		2.08	
Skiffs.....	618.09		121.72			
Motor boat M. R. C. No. 2.....	27.72		8.46			
Floating derrick M. R. C. No. 1.....	213.24		50.91		1.79	24.60
Total.....	32,506.48	1.12	8,400.70		195.33	962.70
Operations during low-water season, 1916:						
Dredge Gamma.....	6,725.63	9.36	1,950.23	2,099.11	38.45	335.76
Dredge Iota.....	8,389.04	1.03	2,652.17	2,111.95	55.03	143.31
Dredge Kappa.....	9,609.62	16.41	2,834.36	3,478.18	72.68	505.55
Dredge B. M. Harrod.....	11,605.37	13.52	3,202.16	5,038.77	53.75	413.63
Steamer inspector.....	6,999.18	.55	1,632.22	2,622.09	30.37	253.88
Steamer Saturn.....	2,695.41	31.68	831.92	629.27	26.19	45.54
Steamer Mercury.....	2,558.34	22.33	816.90	471.04	31.01	50.89
Steamer Venus.....	182.66	13.55	52.73	32.68	2.23	4.63
Steamer Mars.....	1,080.17	10.49	443.17	277.40	9.45	22.80
Total.....	49,845.42	118.92	14,415.86	17,260.49	319.21	1,775.99
Memphis Harbor.....	12,880.14	16.84	4,025.02	7,635.88	71.74	601.89
Wolf River diversion canal.....	21,796.48	30.25	6,183.73	11,981.47	87.83	873.00
Wolf River Dam.....	1,930.66		774.35	107.50		
Side-haul railway dry dock, repairs to.....	343.74		96.45		.27	24.40
Bulldozing and grounds.....	2,434.16		572.65		18.33	208.84
Outfit, care and repair of.....	4,592.16		1,113.62		2.93	.75
Miscellaneous:						
Handling materials.....	2,420.28		655.99		.95	.90
Buoys, construction of.....	375.54		91.72			
	2,795.82		747.71		.95	.90
Total cost of dredging operations.....	170,516.27	264.45	45,825.36	45,051.87	1,045.15	4,656.32

Class of work, or plant to which distributed.	Material.	Permanent plant and outfit.	Hire of plant and renewals.	Repairs (non-personal service and material).	Total.	Grand total.
Care of plant.....	\$597.55					\$60,204.29
Repairs to floating plant:						
Dredge Beta.....	247.53				\$882.48	
Dredge Gamma.....	630.96				3,150.92	
Dredge Delta.....	7.89				136.46	

TABLE NO. 4.—Cost of dredging operations, May 1, 1916, to Apr. 30, 1917—Contd.

Class of work, or plant to which distributed.	Material.	Perma- nent plant and out- fit.	Hire of plant and renewals.	Repairs (non personal service and ma- terial).	Total.	Grand total.
Repairs to floating plant—Contd.						
Dredge Epsilon.....	\$605.41				\$3,252.85	
Dredge Zeta.....	26.56				617.98	
Dredge Iota.....	873.03			\$5.50	4,181.16	
Dredge Kappa.....	1,557.62			3.50	17,397.29	
Dredge Henry Flad.....	2,334.68				0,474.88	
Dredge B. M. Harrod.....	646.82			1.00	4,631.58	
Steamer Sicheu.....	478.05				1,928.79	
Steamer Choctaw.....	335.37				1,280.66	
Steamer Nokomis.....	92.33				351.11	
Steamer Wynoka.....	112.77				338.39	
Steamer Leota.....	334.47				1,739.96	
Steamer Inspector.....	576.68				2,848.45	
Steamer Saturn.....	224.61				757.15	
Steamer Jupiter.....	455.92				1,646.31	
Steamer Vulcan.....	271.84				782.84	
Steamer Venus.....	170.27				989.76	
Steamer Mars.....	581.56				2,028.49	
Steamer Mercury.....	333.37				1,420.34	
Pile sinker No. 13.....	35.02				126.54	
Pile sinker No. 971.....	13.49				119.86	
Pile sinker No. 981.....	89.00				353.78	
Pile sinker No. 982.....	77.04				322.46	
Pile sinker No. 983.....	1.64				129.04	
Pump boat.....	8.00				37.16	
Barge No. 041.....	7.99				32.74	
Barge No. 051.....	91.31				318.53	
Skiffs.....	82.56				822.37	
Motor boat M. R. C. No. 2.....	86				37.04	
Floating derrick M. R. C. No. 1.....	109.81				400.35	
Total.....	11,464.32			\$10.00	53,540.72	\$53,540.72
Operations during low-water season, 1916:						
Dredge Gamma.....	67.14				11,225.68	
Dredge Iota.....	333.96				13,686.49	
Dredge Kappa.....	433.48				17,453.28	
Dredge B. M. Harrod.....	348.84				20,676.04	
Steamer Inspector.....	148.44				11,686.73	
Steamer Saturn.....	164.58				4,424.59	
Steamer Mercury.....	196.77				4,147.28	
Steamer Venus.....	9.74				298.27	
Steamer Mars.....	28.60				1,872.08	
Total.....	1,731.55				85,470.44	85,470.44
Memphis Harbor.....	402.76		\$1,622.92		27,257.19	27,257.19
Wolf River diversion canal.....	958.86		4,227.03	65.00	46,203.65	46,203.65
Wolf River Dam.....	613.53			13,147.51	16,573.55	16,573.55
Side-haul railway dry dock, repairs to.....	8.11				472.97	472.97
Buildings and grounds.....	815.38				4,049.36	4,049.36
Outfit, care and repair of.....	315.87			18.50	6,073.83	6,073.83
Permanent outfit.....		\$9,955.04			9,955.04	9,955.04
Miscellaneous:						
Handling materials.....	20.84			231.42	3,337.38	
Buoys, construction of.....	72.40				539.66	
	93.24			231.42	3,870.04	3,870.04
Total cost of dredging operations..	17,084.24	9,955.04	5,849.95	13,472.43		313,671.08

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1916.*

CAIRO TO MEMPHIS.

[NOTE.—The depths tabulated are merely those recorded by the inspection steamer in passing. No attempt was made to locate and record the minimum depth of water in the thalweg of the crossing.]

Name of crossing.	Miles below Cairo.	Dates of trips.					
		Aug. 8 to 9.	Aug. 16 to 17.	Aug. 29 to 31.	Sept. 5 to 8.	Sept. 12 to 14.	Sept. 19 to 21.
Cairo gauge.....	0	<i>Fect.</i> 18.8-18.3	<i>Fect.</i> 21.2-23.9	<i>Fect.</i> 18-15.4	<i>Fect.</i> 13.3-12.2	<i>Fect.</i> 11.6-11.2	<i>Fect.</i> 10.2-10
New Madrid gauge.....	70	14.9-14.4	15.6-17.7	14.4-12.5	10.7- 9.9	9.4- 9.2	8.4-8.3
Toneys.....	78	12	12	12	13		
Point Pleasant.....	80	13	12	12	9		
Darnells.....	82	12	11	11	11		
Bass.....	93				13	11	
Fritz.....	101						15
Hathaway.....	102			15			13
Sandy Hook.....	103	14	14		10	12	12
Gayoso.....	104					13½	15
Bells Point.....	112						12
Foot Island 16 (upper).....	121			15			
Foot Island 16 (lower).....	121	18	18		12	11	11
Head Island 18.....	122				14		
Cottonwood Point gauge.....	123	12.4-11.8	12.2-14.2	12.3-10	7.4-6.4	5.6-5.4	4.4-4.3
Mitchells.....	125				15	12	15
Island 20.....	128			15	11	11	10
Island 21, foot.....	131	15			14	11	9½
Blue Grass.....	132		15				
Wrights Point.....	135						13½
Hales Point.....	136					15	
River Styx.....	139		10		12	13	10½
Forked Deer.....	146				17		
Foot Island 26.....	153						
Foot Island 26, chute.....	153	11½		13	10	10	9
Round Lake.....	159	11	11	10½	9	1 7/8	14
Head Island 30, chute.....	160				9		
Foot Island 30, chute.....	161				10½		
Plum Point..... chute.....	165					10	28
Drivers.....	169	12	10	12	9		
Yankee Bar (upper).....	170						
Yankee Bar (lower).....	171						
Fulton gauge.....	175	13-12.3	12.1-13.4	13-11.2	8.6-7.8	7.1-6.9	5.9-5.8
Sawmill Point.....	180				14	14	12
Island 34.....	180						
Morgans Point.....	181				14	18	17
Random Shot.....	196				15		11
Pecan Point.....	198						
Corona.....	204		15	18		11	10½
Happy Valley.....	206	18					
Old River.....	209				18		
Foot Island 40.....	220						
St. Clair.....	223				16		14
Ash Chute.....	225				12		
Loosahatchie.....	226					9½	
Paddys Hen.....	227						14
Memphis gauge.....	230	14.6-13.8	13-14	15-13	9.8-8.9	8.2-8	7.1-6.8

¹ Not controlling depth; 9 feet through chute of Island 30.² At night, not in channel.

TABLE No. 5.—Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1916—Continued.

CAIRO TO MEMPHIS—Continued.

Name of crossing.	Miles below Cairo.	Dates of trips.					
		Sept. 26 to 30.	Oct. 2 to 4.	Oct. 10 to 12.	Oct. 17 to 19.	Oct. 24 to 25.	Oct. 31 to Nov. 2.
Cairo gauge.....	0	<i>Feet.</i> 9.8-10.4	<i>Feet.</i> 10.1-9.8	<i>Feet.</i> 8.9-9.3	<i>Feet.</i> 8.6-8.3	<i>Feet.</i> 8.5-8.6	<i>Feet.</i> 12.9-12.6
New Madrid gauge.....	70	7.9-8.3	8.2-7.9	7.2-7.3	6.8-6.7	6.6	9.2-9.6
Toneys.....	78	.....	14	.....	.....	.....	.....
Point Pleasant.....	80	11	12	.....	¹ 8	10	.....
Darnells.....	82	11	11	.....	² 8	⁹	12
Bass.....	93	.....	.....	.....	12	.....	12
Fritz.....	101	.....	.....	.....	.....	.....	.....
Hathaway.....	102	.....	12	.....	11	.....	.....
Sandy Hook.....	103	12	.....	.....	.....	12	12
Gayoso.....	104	13	.....	.....	11	10	.....
Bells Point.....	112	.....	13	.....	.....	.....	.....
Foot Island 16 (upper).....	121	.....	.....	.....	.....	.....	.....
Foot Island 16 (lower).....	121	11	12½	10	9	10	12
Head Island 18.....	122	.....	16	.....	.....	.....	.....
Cottonwood Point gauge.....	123	3.9-4.1	4.2-3.9	3.2-3.1	2.8-2.7	2.4	4.7-5.8
Mitchells.....	125	14	14	12	12	13	13
Island 20.....	128	12	12	9	12	10	13
Foot Island 21.....	131	9	13	11	11	10	11
Blue Grass.....	132	.....	.....	.....	.....	.....	.....
Wrights Point.....	135	9	15	11	.....	11	11
Hales Point.....	136	.....	.....	.....	13	.....	.....
River Styx.....	139	11	8	12	9½	10	12
Forked Deer.....	146	.....	.....	.....	.....	.....	.....
Foot Island 26.....	153	.....	.....	10	.....	11½	12
Foot Island 26, chute.....	153	14	13½	.....	11	.....	.....
Round Lake.....	159	10	11	11	³ 9½	9½	11
Head Island 30, chute.....	160	.....	.....	.....	.....	.....	.....
Foot Island 30, chute.....	161	.....	.....	.....	.....	.....	.....
Plum Point.....	165	9	¹ 8	.....	.....	.....	.....
Drivers.....	169	.....	.....	⁴ 8	⁸ 8	9	10
Yankee Bar (upper).....	170	.....	.....	.....	.....	.....	.....
Yankee Bar (lower).....	171	.....	.....	.....	.....	.....	.....
Fulton gauge.....	175	5.4-5.5	5.7-5.4	4.9-4.6	4.5-4.4	4.1	6-7.2
Sawmill Point.....	180	14	13	11	13	11	.....
Island 34.....	180	.....	.....	.....	.....	.....	12
Morgan's Point.....	181	.....	.....	.....	.....	.....	.....
Rando m Shot.....	196	12	.....	10	⁵ 8½	10½	.....
Pecan Point.....	198	.....	.....	.....	.....	11	.....
Corona.....	204	9	14	9	⁶ 7	⁸	11
Centennial Point.....	.....	10½	13	.....	.....	.....	.....
Happy Valley.....	206	.....	.....	.....	.....	.....	.....
Old River.....	209	.....	.....	.....	.....	.....	.....
Foot Island 40.....	220	.....	14	.....	.....	.....	.....
St. Clair.....	223	12	.....	12	11	.....	12
Ash Chute.....	225	.....	.....	.....	.....	.....	.....
Loosahatchie.....	226	.....	.....	.....	.....	.....	.....
Paddys Hen.....	227	.....	13	13	11	11	12
Memphis gauge.....	230	6.5-6.4	6.6	6-5.7	5.6-5.5	5.1	6.5-7.9

¹ Channel changing; map necessary to determine best water.² Dredge in channel.³ Soundings taken at night; very dark and stormy.⁴ Map showed 9 feet; crooked channel.⁵ Not controlling depth.

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low water season of 1916—Continued.*

TO MEMPHIS—Continued.

Name of crossing.	Miles below Cairo.	Dates of trips.				
		Nov. 7 to 8.	Nov. 14 to 15.	Nov. 21 to 23.	Nov. 28 to 29.	Dec. 5 to 6.
Cairo gauge.....	0	<i>Fect.</i> 10.1-9.8	<i>Fect.</i> 8.8-9	<i>Fect.</i> 9.1-9.2	<i>Fect.</i> 9.6-9.5	<i>Fect.</i> 9.8-10.
New Madrid gauge.....	70	7.8-7.5	6.7	6.8	7.1-7.0	7.1-7.
Tonevs.....	78					
Point Pleasant.....	80	11				
Darnells.....	82	11				
Bass.....	93					
Fritz.....	101					
Hathaway.....	102					
Sandy Hook.....	103	12				
Gavoso.....	104					
Bells Point.....	112					
Foot Island 16 (upper).....	121	11			11	
Foot Island 16 (lower).....	121	11	10			10
Head Island 18.....	122					
Cottonwood Point gauge.....	123	4-3.6	2.7-2.6	2.6	3.0	3.
Mitchells.....	125					
Island 20.....	125	12				
Foot Island 21.....	131				10½	
Blue Grass.....	132			11		
Wrights Point.....	135					
Hales Point.....	136					
River Styx.....	139	13	9	10½	10½	11
Forked Deer.....	146					
Foot Island 26.....	153	11				11
Foot Island 26, chute.....	153		9	12	11	
Round Lake.....	159	10	11	10½	11	11
Head Island 30, chute.....	160					
Foot Island 30, chute.....	161					
Plum Point.....	165					
Drivers.....	169	10	10			
Yankee Bar (upper).....	170				9	10
Yankee Bar (lower).....	171			9		10
Fulton gauge.....	175	6-5.4	4.4	4.5	4.7-4.8	4
Sawmill Point.....	180	14				
Island 34.....	180					
Morgans Point.....	181					
Random Shot.....	196					
Pecan Point.....	198					
Corona.....	204	11		10½	10½	10
Happy Valley.....	206					
Old River.....	209					
Foot Island 40.....	220					
St. Clair.....	223	14			11	
Ash Chute.....	225					
Loosahatchie.....	226					
Paddys lien.....	227	14				
Memphis gauge.....	230	7-6.4	5.4-5.2	5.4	5.4-5.5	5

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1916—Continued.*

MEMPHIS TO MHOON LA.

[NOTE.—The depths tabulated are merely those recorded by the inspection steamer in passing. No attempt was made to locate and record the minimum depth of water in the thalweg of the crossing.]

Name of crossing.	Miles below Cairo.	Dates of trips.						
		Sept. 4.	Sept. 11.	Sept. 18.	Sept. 23.	Oct. 2.	Oct. 7.	Oct. 14.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Memphis gauge.....	230	10.3	8.4	7.2	6.8	6.6	6.2	5.7
Berkleys.....	237							
Wyanoke.....	238	14	12	14	12	13	11	11
Dismal Point.....	239							9
Ensleys.....	241							
Head Josie Harry Chute.....	243	17	15	14				
Coahoma.....	248	9	11	18	10	9	10	9
Cow Island.....	252			18		11	14	12
Cat Island.....	256			27½		10	10½	11
Mhoon Landing gauge.....	276	9.0	6.1	4.9	4.1	3.7	3.4	2.6

¹ At night.

² Channel dredged to 10½ feet.

Name of crossing.	Miles below Cairo.	Dates of trips.					
		Oct. 21.	Oct. 28.	Nov. 4.	Nov. 11.	Nov. 18.	Nov. 25.
		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Memphis gauge.....	230	5.4	5.2	8.1	5.9	5.2	5.4
Berkleys.....	237					11	
Wyanoke.....	238	11	11	14	12	14	12
Dismal Point.....	239	10	10½	14	9		
Ensleys.....	241					11	10
Head Josie Harry Chute.....	243						
Coahoma.....	248	9	9	11	10	10½	10½
Cow Island.....	252	13	11	15	12	11	11
Cat Island.....	256	9½	9	16	12		
Mhoon Landing gauge.....	276	2.1	1.9	5.8	3.2	2.1	2.2

TABLE No. 6.—*Dimensions of channel through bars, Mississippi River below Cairo, dredging season 1916, determined from surveys.*

Miles below Cairo.	Name of crossing.	Date of survey, 1916.	Least depth in channel 250 feet wide.	Least width of 9-foot channel.	Gauges and their readings at time of survey.			
					Readings.		Standard gauge at—	
					Local gauge.	Stand- ard gauge.		
			<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>		
30	Medleys.....	Oct. 15.....	16	2,400	9.3	9.3	Columbus. New Madrid.	
78	Toneys.....	Aug. 11.....	10.5	650	14.1	14.1		
		Aug. 28.....	13	1,000	14.8	15.1		
		Sept. 4.....	12.5	400	11.2	10.9		
		Sept. 13.....	11.5	550	9.8	9.3		
		Sept. 21.....	9.5	450	8.3	8.3	Do.	
		Oct. 24.....	12	850	6.7	6.6		
80	Point Pleasant.....	Aug. 12.....	13	(1)	13.8	14		
		Aug. 30.....	14	(1)	12.8	13.4		
		Sept. 13.....	10	750	9.8	9.3		
		Sept. 20.....	10.5	700	8.5	8.4		
		Sept. 28.....	10.5	300	8.2	8.1		
		Oct. 6.....	11	400	7.7	7.7		
		Oct. 17.....	9	250	6.9	6.8		
		Nov. 2.....	13	600	9.7	9.6		
		Nov. 16.....	10.5	350	6.7	6.7		
		Nov. 25.....	10	400	6.8	6.8	Do.	
		Dec. 3.....	12	400	6.9	7.1		
82	Darnells.....	Aug. 17.....	18.5	(1)	17.1	17.4		
		Sept. 4.....	9.5	800	11.2	10.9		
		Sept. 12.....	11	420	9.9	9.4		
		Sept. 25.....	11	280	8	7.9		
		Oct. 6.....	9	250	7.7	7.7		
		Oct. 21.....	8	200	6.7	6.6		
		Nov. 3.....	10.5	350	9.3	9.3		
		Nov. 17.....	9	250	6.7	6.9		
		Nov. 24.....	12	400	6.8	6.8	Cottonwood Point.	
		Dec. 1-2.....	10.5	700	6.9	6.9-7		
104	Gayoso.....	Sept. 9.....	11.5	1,100	6.4	6.2		
		Sept. 16.....	14	400	5.5	5		
		Oct. 9.....	12.5	600	3.4	3.5		
		Nov. 19.....	10	475	3.7	2.8	Do. Do. Fulton.	
121	Island 16.....	Oct. 5.....	10.5	1,000	3.8	3.8		
132	Blue Grass.....	Oct. 6.....	10	425	3.8	3.7		
139	River Styx.....	Aug. 18.....	16.5	2,800	10.5	14.5		
		Sept. 5.....	11	250	8.5	8.6	Do.	
		Oct. 7.....	11	500	5.5	5.2		
		Oct. 24.....	11	300	4.5	4.1		
		Dec. 10.....	13	1,000	6	5.9		
		Sept. 6.....	8	125	8	8.4	Do.	
153	Island 26, foot.....	Sept. 17.....	9	250	6.5	6.2		
		Sept. 30.....	10.5	300	6	5.5		
		Dec. 6.....	12	800	5	4.8		
159	Round Lake.....	Aug. 28.....	12	1,400	13.5	13.7	Do.	
		Sept. 18.....	10	275	6	6.1		
		Oct. 17.....	8.5	200	4.5	4.4		
		Nov. 5.....	12	300	6.5	6.7		
		Nov. 12.....	9.5	275	5	4.8	Do. Do. Do.	
		Dec. 5.....	9.5	300	5	4.8		
164	Osceola.....	Nov. 18.....	10.5	250	4.5	4.5		
165	Plum Point.....	Sept. 12.....	9.5	400	7	7.1		
167	Bullerton.....	Aug. 26.....	12.5	400	14.5	15.2	Do.	
		Sept. 9-11.....	11.5	250	8	7.6-7.2		
		Oct. 9-10.....	8	200	5.5	5.0-4.9		
		Dec. 2.....	8	100	5	4.7		
		Sept. 19.....	11	360	6	5.9	Do.	
170	Yankee Bar.....	Oct. 3.....	8.5	.....	6	5.6	
		Oct. 23.....	12	340	4	4.1		
		Dec. 22.....	8	100	4.5	4.4		
171	Flower Island.....	Oct. 21.....	11	350	4	4	Do. Memphis.	
		Nov. 14.....	10.5	370	4.5	4.4		
204	Corona.....	Nov. 9.....	11.5	1,300	6.5	6.3		
		Dec. 13.....	13.5	(1)	7.5	7.4		
248	Coahoma.....	Aug. 31.....	13	1,120	12.5	13.2	Do.	
		Sept. 28.....	9	250	6.5	6.4		
		Nov. 11.....	9.5	420	6	5.9		
252	Daisy.....	Oct. 2.....	12.5	660	6.5	6.7		
256	Cat Island.....	Sept. 22.....	8	7	6.8	Do. Do.	
		Sept. 29.....	9	250	6.5	6.4		
		Nov. 10.....	15.5	650	6.5	6		
333	Island 63.....	Oct. 14-15.....	15	600	5	5		
765	Angola and Smithland.	Oct. 26-27.....	9	250	5.8	5.7-5.6	Helena. Red River Land- ing.	

1 Unlimited.

TABLE NO. 7.—Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1916.

GAMMA.

Points of operation.	Distribution of time.								Total.
	Placing plant.	Dredging.	Changing cuts.	Repairing.	Passing boats.	Making uptow.	Towing.	Not working awaiting lower stage, etc.	
Yankee Bar (170), Sept. 11-20.	Hours. 7.30	Hours. 74.15	Hours. 3.25	Hours. 5.20	.....	Hours. 1.25	Hours. 173.00	Hours. 2 55.05	Hours. 220.00
Foot Island 26 (153), Sept. 20-27.	2.55	79.15	9.35	13.10	0.20	7.45	7.45	2 50.15	171.00
West Memphis (232), Sept. 27-Oct. 20 ³.	.....	37.25	2.15	168.50	.....	.....	4 30.50	315.55	555.15
Yankee Bar (170), Dec. 5-8.	2.10	13.25	.....	8.25	.....	7.00	46.20	.....	77.20
Luxora (161), lying up Dec. 8-21.	.....	.....	.....	.....	.....	1.20	16.25	290.45	308.30
Going into winter quarters, Dec. 21-23.	.....	.....	.....	.....	.....	1.40	24.40	35.40	62.00
Total and average	12.35	204.20	15.15	195.45	.20	19.10	199.00	747.40	1,394.05

IOTA.

Coahoma (248), Sept. 2-23.	9.20	51.20	5.20	4.05	0.25	4.10	54.35	374.55	504.10
Cat Island (256), Sept. 23-Nov. 25.	7.40	89.55	5.25	7.20	.....	3.35	3.10	6 1,394.35	1,511.40
West Memphis (232), lying up Nov. 25-Dec. 27.	.....	.....	.....	.....	.....	2.00	13.45	763.15	779.00
Total and average.	17.00	141.15	10.45	11.25	.25	9.45	71.30	2,532.45	2,794.50

KAPPA.

Bullerton (167), Aug. 9-18.	8.30	34.55	3.50	42.45	0.30	.....	75.30	6 59.00	225.00
Osceola (165), lying up Aug. 18-26.	.....	.....	.....	.....	.....	.....	2.35	186.40	189.15
River Styx (139), Aug. 26-Sept. 1.	2.10	93.25	6.45	7.20	.....	1.45	25.50	12.00	149.15
Round Lake (159), Sept. 1-26.	4.45	132.45	15.45	224.40	2.10	3.45	4.55	8 216.15	605.00
Foot Island 26 (153), Sept. 26-29.	7.40	25.40	5.25	1.05	.....	.....	16.30	.....	56.20
Luxora (161), lying up Sept. 29-Oct. 4.	.....	.....	.....	.....	.....	6.30	8.10	116.00	130.40
Yankee Bar (170), Oct. 4-7.	3.25	45.30	5.30	.....	1.40	.....	1.30	9.45	67.20
Luxora (161), lying up Oct. 7-11.	.....	.....	.....	.....	.....	.....	4.10	98.00	102.10
Flower Island (171), Oct. 11-19.	9 15.45	46.25	3.40	10 108.00	.....	1.15	1.45	11 11.40	188.30
Yankee Bar, upper (170), Oct. 19-22.	1.00	38.25	7.20	.50	.....	.....	2.30	12 21.25	71.30
Luxora (161), lying up Oct. 22-Nov. 7.	.....	.....	.....	.....	.....	.30	4.15	376.35	381.20
Round Lake (159), Nov. 7-10.	.55	54.50	12.40	3.30	4.10	.....	1.00	.....	77.05
Luxora (161), lying up Nov. 10-29.	.....	.....	.....	.....	.....	1.55	1.00	446.40	449.35
Going into winter quarters, Nov. 29-Dec. 6.	.....	.....	.....	.....	.....	4.10	25.50	157.00	187.00
Total and average.	44.10	471.55	60.55	388.10	8.30	19.50	175.30	1,711.00	2,880.00

¹ Includes 4 hours aground.² Includes 24.10 hours cleaning boilers.³ Dredging in front of marine ways.⁴ Includes 1 hour wind bound and 8.40 hours ground.⁵ Includes 19.30 hours lost account short of labor.⁶ Includes 27 hours cleaning boilers, 12 hours half holiday, and 5.30 hours short of deck crew.⁷ Includes 184.30 hours repairing boilers.⁸ Includes 80.10 hours short of crew, 44.25 hours cleaning boilers, 36 hours holiday, 2.35 hours lost account fog.⁹ Includes 12 hours short of crew.¹⁰ Repairing suction and discharge pipe line.¹¹ Short of firemen.¹² Includes 12.05 hours short of firemen and 20 minutes lost account of storm.

TABLE NO. 7.—*Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1916—Continued.*

B. M. HARROD.

Points of operation.	Distribution of time.								Total.
	Placing plant.	Dredging.	Changing cuts.	Repairing.	Passing boats.	Making uptow.	Towing.	Not working, awaiting lower stage, etc.	
Point Pleasant (80), lying up, Aug. 10-29.....							84.00	396.00	480.00
Foot Toney's Chute (78), Aug. 30-Sept. 3.....	3.35	62.50	3.20	1.00	1.30	10.00	1.45	¹ 20.10	104.10
Darnells (82), Sept. 3-9.....	6.20	77.00	2.35	.....	.45	1.45	1.25	² 51.15	141.05
Gayoso (104), Sept. 9-13.....	6.45	38.30	1.30	.....	1.25	3.00	6.30	³ 45.15	102.55
Caruthersville (110), lying up, Sept. 13-18.....						11.50	1.00	101.15	114.05
Darnells (82), second time, Sept. 18-23.....	4.30	58.50	2.30	.....	.....	.....	⁴ 48.15	⁵ 10.00	124.05
Point Pleasant (80), Sept. 23-29.....	4.00	61.20	1.40	⁶ 45.00	.....	4.40	2.00	⁷ 25.15	143.55
Caruthersville (110), lying up, Sept. 29-Oct. 11.....							3.45	298.00	301.45
Darnells (82), third time, Oct. 12-24.....	9.35	95.15	12.50	6.00	1.30	7.45	26.00	⁸ 139.50	298.45
Point Pleasant (80), second time, Oct. 24-Nov. 8.....	2.00	21.25	1.20	33.15	.....	.....	1.00	303.45	362.45
Darnells (82), fourth time, Nov. 8-10.....	7.25	20.35	2.00	.....	.....	.....	.....	11.15	41.15
Caruthersville (110), lying up, Nov. 10-Dec. 21.....						4.00	4.30	980.45	989.15
Going into winter quarters, Dec. 21-27.....						2.30	67.15	86.15	156.00
Total and average.....	44.10	435.45	27.45	85.15	5.10	45.30	247.25	2,469.00	3,360.00

GAMMA.

Points of operation.	Distance towed.	Number of cuts.	Total length of cuts.	Average rate of advance per hour.	Depth suction lowered.	Average depth of cut.	Average steam pressure per square inch.	Average speed main pump, revolutions per minute.
Yankee Bar (170), Sept. 11-20.....	<i>Miles.</i> 65	9	<i>Feet.</i> 6,875	<i>Feet.</i> 93	<i>Feet.</i> 15	<i>Feet.</i> 6.3	<i>Pounds.</i> 139	142
Foot Island 26 (153), Sept. 20-27.....	14	19	13,825	174	16	5.1	140	145
West Memphis (232), Sept. 27-Oct. 20 ⁹	79	8	3,575	96	15.5-16.5	6.3	140	145
Yankee Bar (170), Dec. 5-8.....	62	1	1,050	78	15	6.4	138	144
Luxora (161), lying up Dec. 8-21.....	9	.....	.....	.....	.....	.....	.....	.....
Going into winter quarters, Dec. 21-23.....	71	.....	.....	.....	.....	.....	.....	.....
Total and average.....	300	37	25,325	124	15-16.5	5.7	139	144

¹ Includes 12 hours half holiday.² Includes 24 hours holiday, 12.30 hours cleaning boilers, and 1.30 hours coaling steamer Inspector.³ Includes 24 hours cleaning boilers and 11.45 hours half holiday.⁴ Includes 15.15 hours aground and 6.30 hours coal barge aground.⁵ Short of labor.⁶ Repairing pontoons and cleaning boilers.⁷ Includes 7 hours delayed by high wind.⁸ Includes 18 hours short of labor and 3.45 hours pulling steamer Stacker Lee off ground.⁹ Dredging in front of marine ways.

TABLE NO. 7.—Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1916—Continued.

IOTA.

Points of operation.	Distance towed.	Number of cuts.	Total length of cuts.	Average rate of advance per hour.	Depth suction lowered.	Average depth of cut.	Average steam pressure per square inch.	Average speed main pump, revolutions per minute.
	<i>Miles.</i>		<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Pounds.</i>	
Coahoma (248), Sept. 2-23.....	16	8	6,350	124	16-18	5.6	110	152
Cat Island (256), Sept. 24-Nov. 25.....	8	9	20,325	226	14-17	5.3	136	160
West Memphis (232), lying up Nov. 25-Dec. 27.....	24							
Total and average.....	48	17	26,675	189	14-18	5.4	123	156

KAPPA.

Bullerton (167), Aug. 9-18.....	65	6	7,800	223	17	5.4	126	128
Osceola (165), lying up Aug. 18-26.....	2							
River Styx (139), Aug. 26-Sept. 1.....	26	10	21,350	229	18	4.8	123	128
Round Lake (159), Sept. 1-25.....	20	22	28,950	218	13-15	5.0	122	129
Foot Island 26 (153), Sept. 26-29.....	6	8	8,450	329	15	3.2	124	131
Luxora (161), lying up Sept. 29-Oct. 4.....	8							
Yankee Bar (170), Oct. 4-7.....	9	10	14,100	310	14-15	3.8	124	130
Luxora (161), lying up Oct. 7-11.....	9							
Flower Island (171), Oct. 11-19.....	10	10	11,625	250	14	4.8	124	130
Yankee Bar, upper (170), Oct. 19-22.....	1	8	9,525	248	14-15	5.4	125	131
Luxora (161), lying up Oct. 22-Nov. 7.....	9							
Round Lake (159), Nov. 7-10.....	2	12	17,350	316	15	3.4	122	130
Luxora (161), lying up Nov. 10-29.....	2							
Going into winter quarters, Nov. 29-Dec. 6.....	71							
Total and average.....	240	86	119,150	252	13-18	4.5	124	130

B. M. HARROD.

Point Pleasant (80), lying up, Aug. 10-20.....	152							
Foot Toney's chute (78), Aug. 30-Sept. 3.....	2	10	13,250	211	18	5.1	131	134
Darnells (82), Sept. 3-9.....	4	9	17,300	225	16-18	6.3	136	138
Gayoso (104), Sept. 9-13.....	22	7	7,800	203	18	6.5	134	134
Caruthersville (110), lying up, Sept. 13-18.....	6							
Darnells (82), second time, Sept. 18-23.....	28	7	13,900	236	15-17	6.6	136	135
Point Pleasant (80), Sept. 23-29.....	2	7	18,200	297	15-16	6.8	137	138
Caruthersville (110), lying up, Sept. 29-Oct. 11.....	30							
Darnells (82), third time, Oct. 12-24.....	28	14	25,400	267	15-17	5.8	136	135
Point Pleasant (80), second time, Oct. 24-Nov. 8.....	2	8	6,150	287	15-16	6.4	138	135
Darnells (82), fourth time, Nov. 8-10.....	2	7	6,250	304	15	5.0	140	136
Caruthersville (110), lying up, Nov. 10-Dec. 21.....	28							
Going into winter quarters, Dec. 21-27.....	122							
Total and average.....	428	69	108,250	248	15-18	6.1	136	136

APPENDIX 1A.

LAWS AFFECTING THE MISSISSIPPI RIVER COMMISSION, JULY 1, 1916, TO
JUNE 30, 1917.

[Public—No. 168—64th Congress.]

[H. R. 12193.]

AN ACT Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

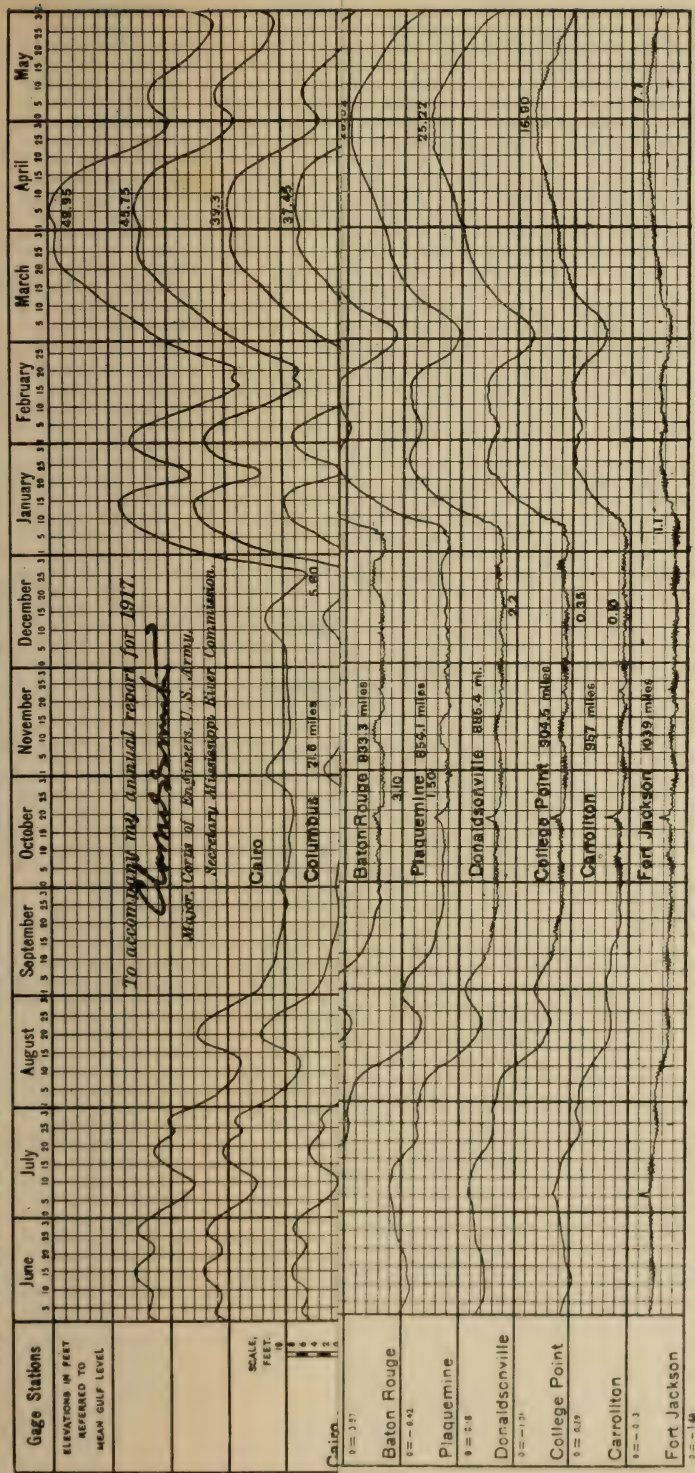
Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That the following sums of money be, and are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to be immediately available, and to be expended under the direction of the Secretary of War and the supervision of the Chief of Engineers, for the construction, completion, repair, and preservation of the public works hereinafter named:

* * * * *

Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission: Continuing improvement with a view to securing a permanent channel depth of nine feet, \$6,000,000, which sum shall be expended under the direction of the Secretary of War in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, for the general improvement of the river, for the building of levees, and which may be done, in the discretion of the Secretary of War, by hired labor or otherwise, between Head of Passes and Cape Girardeau, Missouri, and for surveys, including the survey from Head of Passes to the headwaters of the river, in such manner as in their opinion shall best improve navigation and promote the interests of commerce at all stages of the river: *Provided*, That of the money hereby appropriated so much as may be necessary shall be expended in the construction of suitable and necessary dredge boats and other devices and appliances and in the maintenance and operation of the same: *Provided further*, That the watercourses connected with said river and the harbors upon it, now under the control of the Mississippi River Commission and under improvement, together with the harbor at Vicksburg, Mississippi, and the Ohio River from its mouth to the mouth of the Cache River, which are hereby transferred to and placed under the control and jurisdiction of such commission, may, in the discretion of said commission, upon approval by the Chief of Engineers, receive allotments for improvements now under way or hereafter to be undertaken, to be paid for from the amount herein appropriated: *Provided further*, That the report of the Mississippi River Commission, contained in House Document Numbered Six hundred and sixty-seven, Sixty-third Congress, second session, shall not be construed as a project requiring special congressional action: *Provided further*, That no part of the improvement of the Ohio River, with a view to the construction of locks and dams, shall be considered as transferred to or placed under the control and jurisdiction of the Mississippi River Commission: *Provided further*, That a survey with a report shall be made by the Mississippi River Commission of the Atchafalaya River in accordance with the general plan of said commission for the improvement of the Mississippi River, and in making such survey and report, if in their opinion the improvement of the Atchafalaya is desirable, consideration shall be given and recommendation made as to any plans for cooperation on the part of local interests.

The jurisdiction of the Mississippi River Commission is hereby extended so as to include that part of the Arkansas River between its mouth and the intersection thereof with the division line between Lincoln and Jefferson Counties, and any funds which are herein or may be hereafter appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River, and which may be allotted to levees and bank revetment, may be expended within the limits of said extended jurisdiction under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, and upon like terms and conditions for levees and

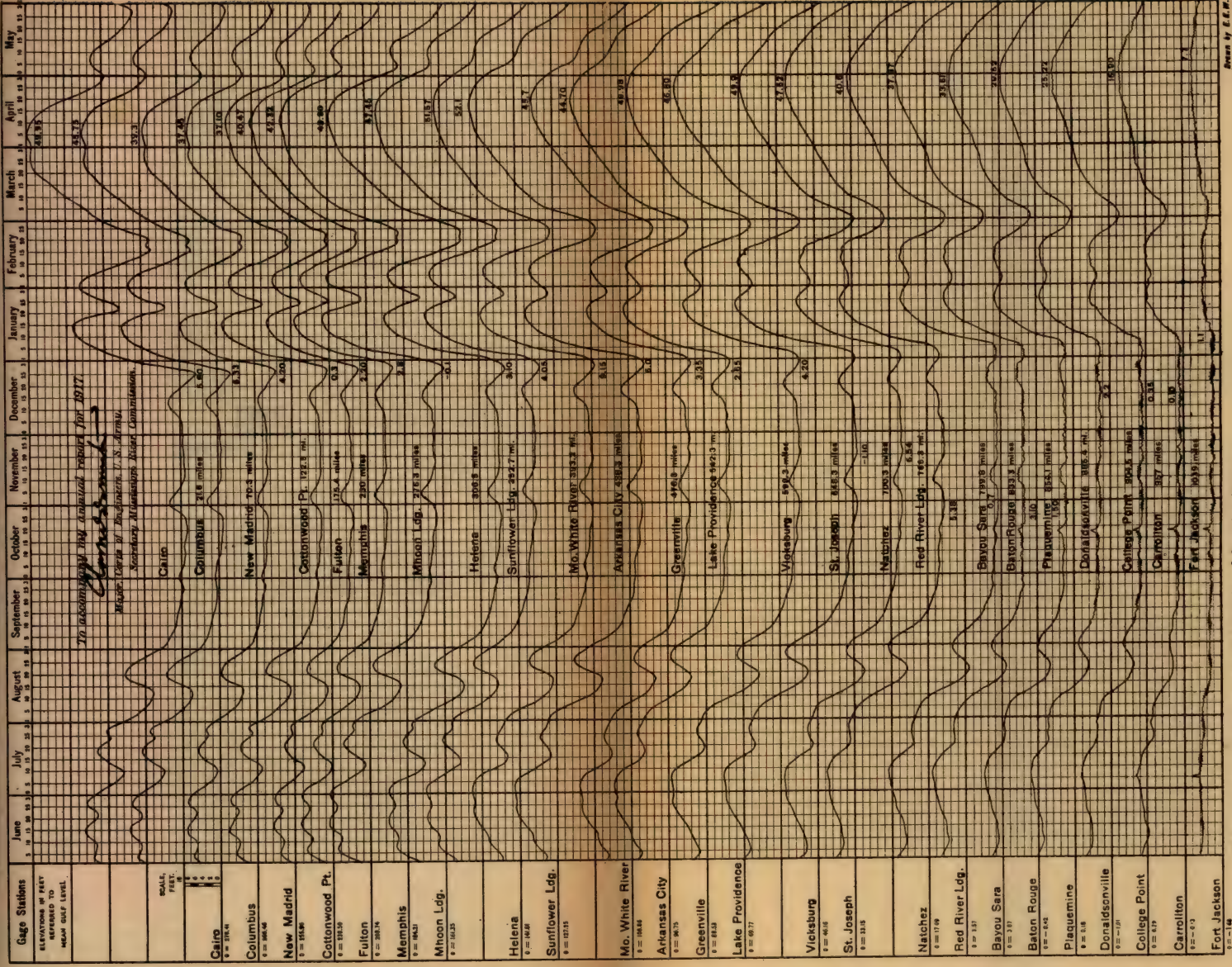
HYDROGRAPHS OF THE MISSISSIPPI RIVER CAIRO, ILL., TO FORT JACKSON, LA., 1916-17.



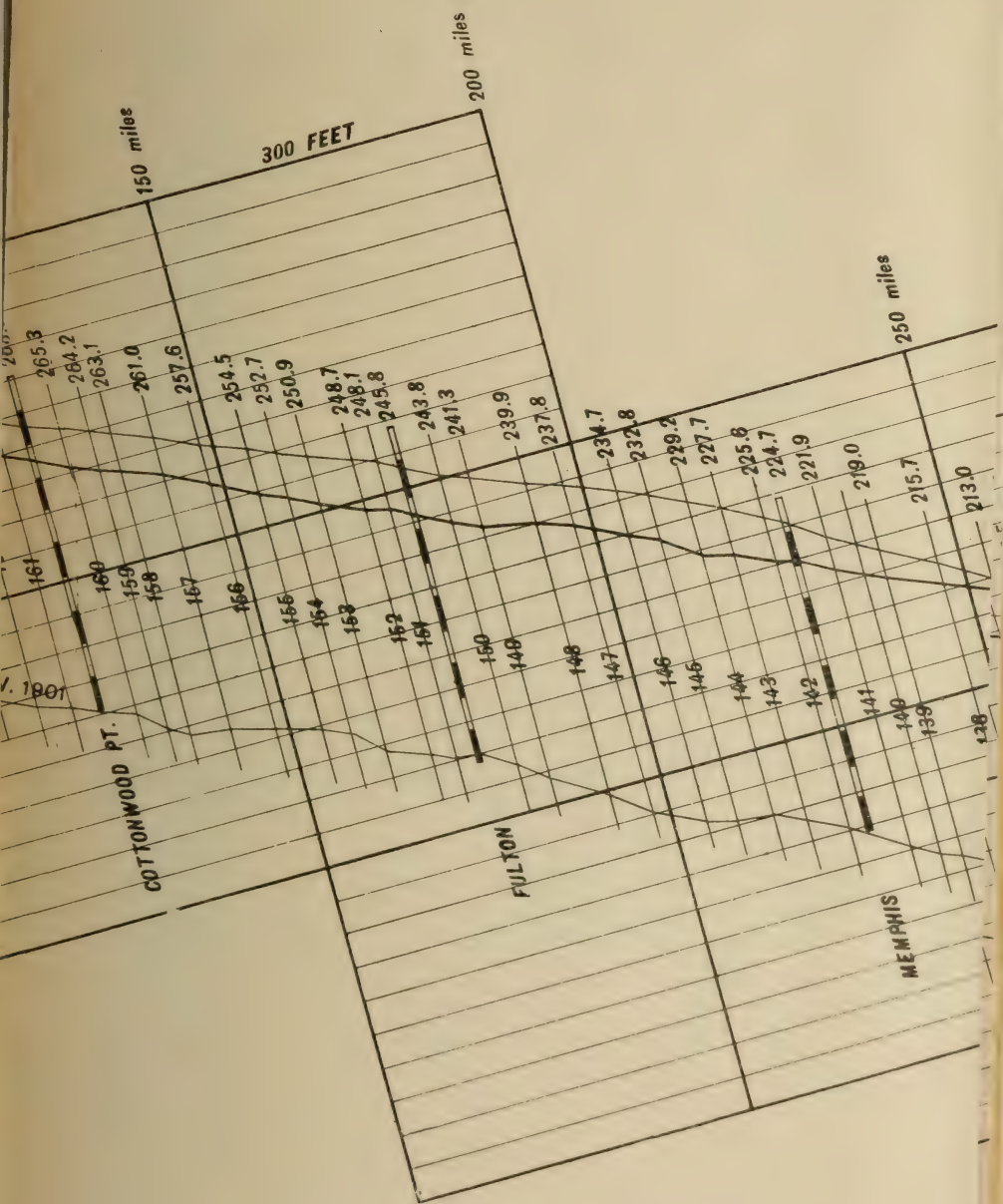
Note.—The numerals on curves at highest and lowest points are maximum and minimum gage readings of the year in feet.

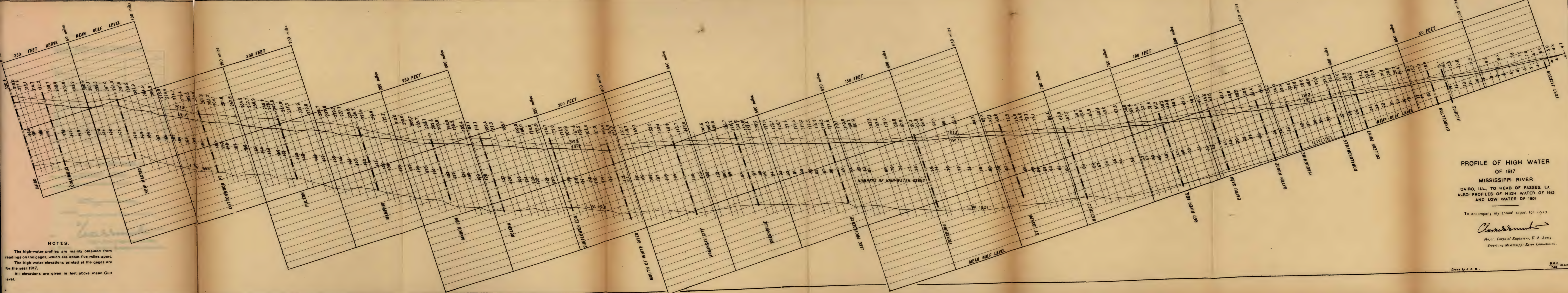
Drawn by E. B. W.

M.R.C. Sheet L.
749

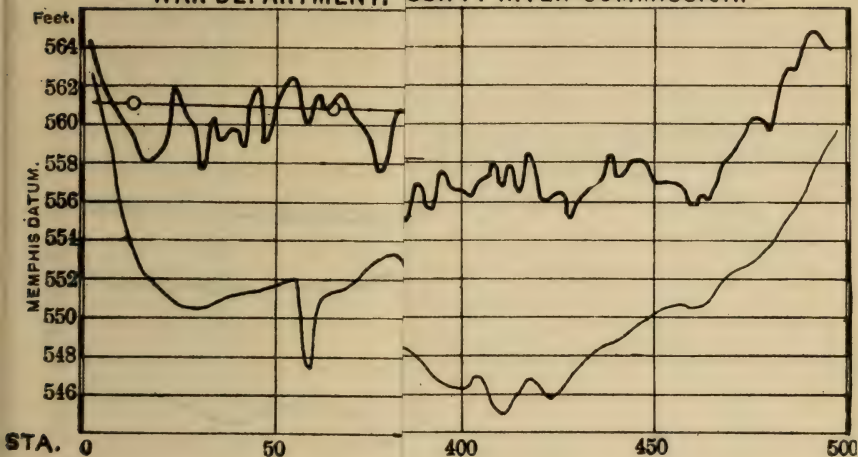


Note.—The numerals on curves at highest and lowest points are maximum and minimum gage readings of the year in feet.





WAR DEPARTMENT. MISSISSIPPI RIVER COMMISSION.



NOTES.

MO. AND ROCK ISLAND, ILL.

Levee from Sta. 3 to 390 is along M DISTRICT LEVEE

Levee from Sta. 390 to 500 is along B MILES ABOVE CAIRO

LE, FEET.

10,000

15,000

LEGEND

company my Annual Report for 1917:

Top of Levee.

Inside Ground Line.

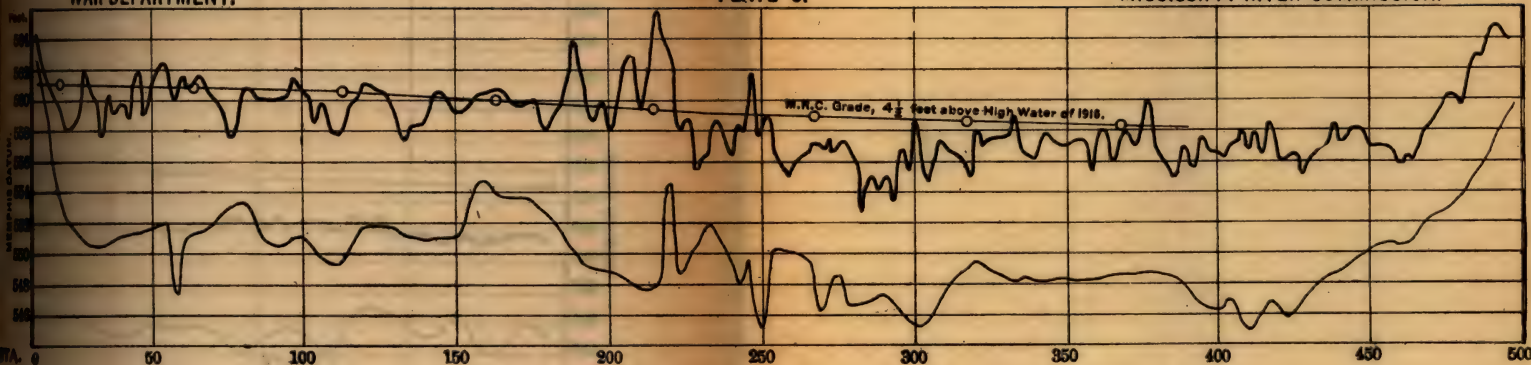
Established M.R.C. Grade.

13751—ENG 1917. (To face page)

Charles Smith

Major, Corps of Engineers, U.S. Army,

Secretary Mississippi River Commission.



NOTES.

Levee from Sta. 2 to 390 is along Mississippi River.

Levee from Sta. 390 to 500 is along Copperas Creek.

LEGEND.

Top of Levee. _____

Inside Ground Line. _____

Established M.R.C. Grade. _____

18751—ENG 1917. (To face page 3502.) No. 3

LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.

DRURY DRAINAGE DISTRICT LEVEE

LEFT BANK 485 TO 478 MILES ABOVE CAIRO

HORIZ. SCALE, FEET.

0 5,000 10,000 15,000

Submitted:

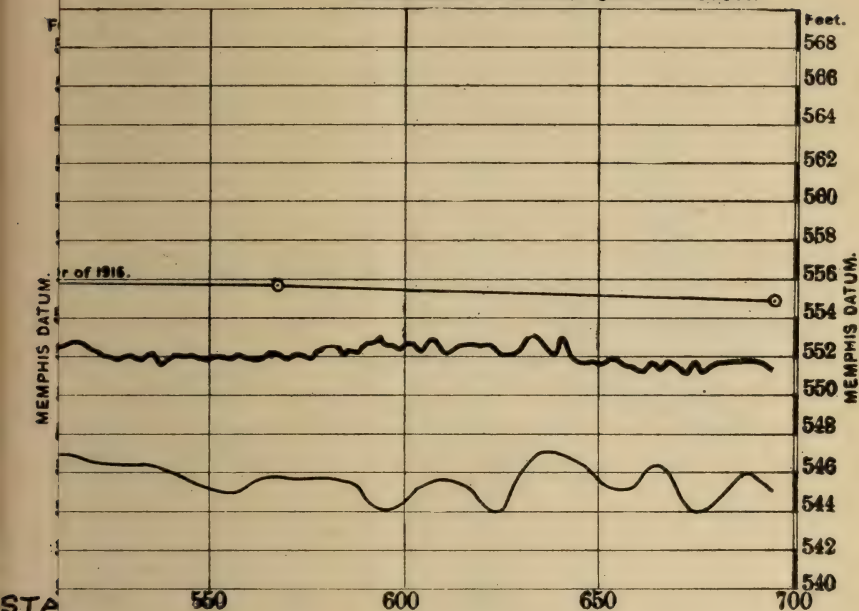
E. J. THOMAS,
Assistant Engineer.

To accompany my Annual Report for 1917:

Major, Corps of Engineers, U.S. Army,
Secretary Mississippi River Commission.

Drawn by S.J.C., June, 1917.

MISSISSIPPI RIVER COMMISSION.



S BETWEEN CAPE CIRARDEAU, MO. AND ROCK ISLAND, ILL.

MUSCATINE ISLAND LEVEE

GHT BANK, 481 TO 487 MILES ABOVE CAIRO.

HORIZ. SCALE, FEET.

5,000

10,000

15,000

To accompany my Annual Report for 1917:

MAS,

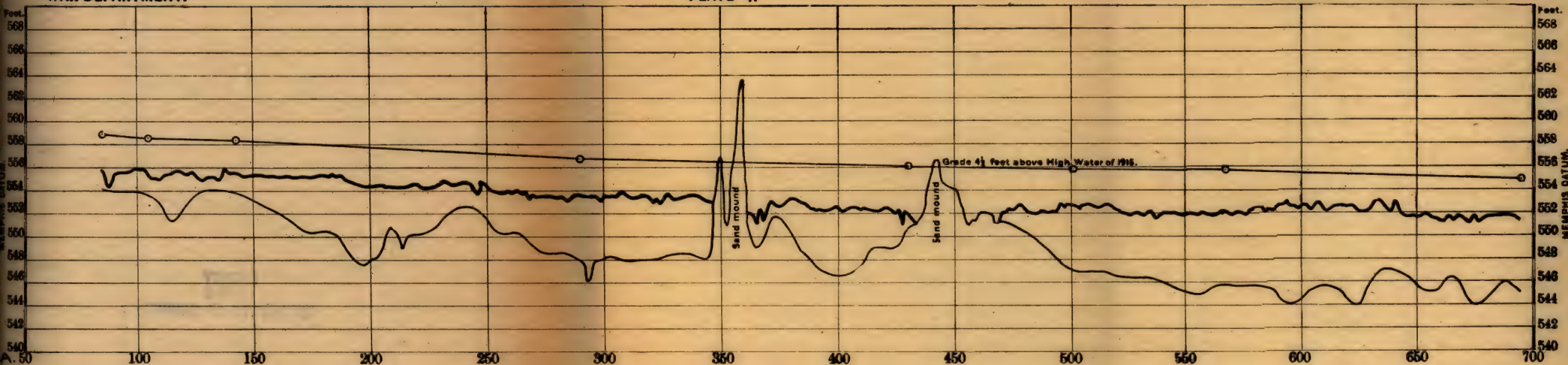
Engineer.

B., June, 1917.

Charles Smith

Major, Corps of Engineers, U.S. Army,

Secretary Mississippi River Commission.



LEGEND.

Top of Levee. _____
 Ground Line. _____
 Established M.R.C. Grade: ○ — ○

LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.
MUSCATINE ISLAND LEVEE

RIGHT BANK, 481 TO 487 MILES ABOVE CAIRO.

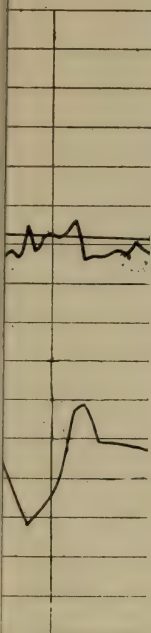
HORIZ. SCALE, FEET.
 0 5,000 10,000 15,000

Submitted:
E. J. THOMAS,
 Assistant Engineer.

Drawn by J. A. O'S., June, 1917.

To accompany my Annual Report for 1917:

Charles Smith
 Major, Corps of Engineers, U.S. Army,
 Secretary Mississippi River Commission.

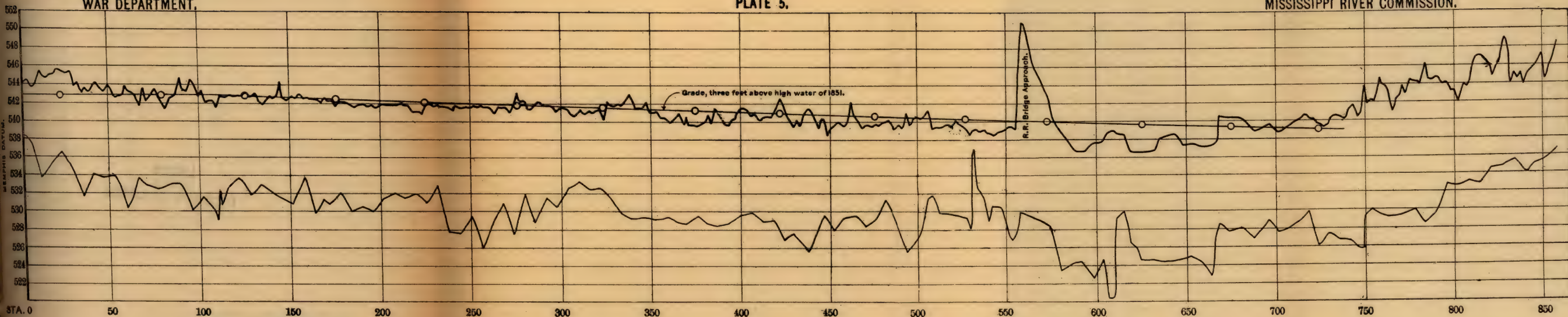


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 NATIONAL BUREAU OF STANDARDS

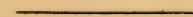


LEGEND.

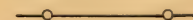
Top of Levee.



Ground Line.



Established M.R.C. Grade.



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.
 LEVEES IN HENDERSON CO. DRAINAGE DISTRICTS NOS. 1 & 2.
 LEFT BANK 436 TO 425 MILES ABOVE CAIRO

HOR. SCALE, FEET.
 0 5000 10000 15000

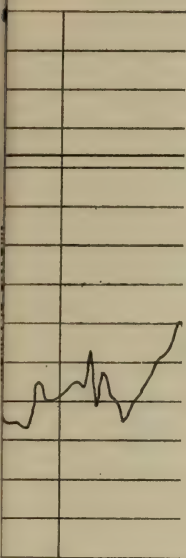
Submitted:

E. J. THOMAS,
 Assistant Engineer.

To accompany my Annual Report for 1917:

Charles Smith
 Major, Corps of Engineers U.S. Army,
 Secretary Mississippi River Commission.

Drawn by S.J.C., June, 1917.



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450

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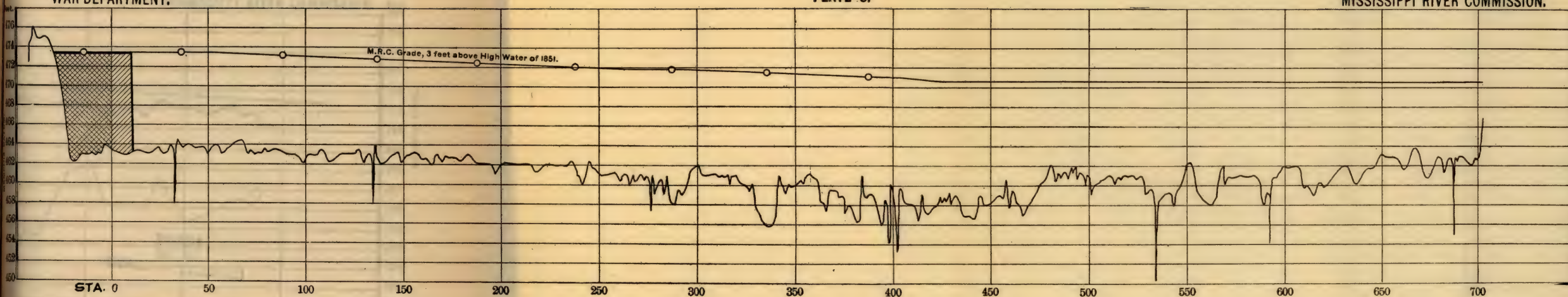
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NOTES.

Levee between Sta. 0 and 305 is along Salt River.

Levee between Sta. 305 and 703 is along Mississippi River.

From Sta. 703 to 734, levee runs back to high ground near Ashburn, Mo.

LEGEND.

Top of Levee.



Ground Line.



Established M.R.C. Grade.



Built by Local Authorities in 1916-17.



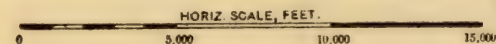
Built by U.S. in 1916-17.



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.

RIVERLAND LEVEE DISTRICT LEVEE

RIGHT BANK 305 TO 312 MILES ABOVE CAIRO



Submitted:

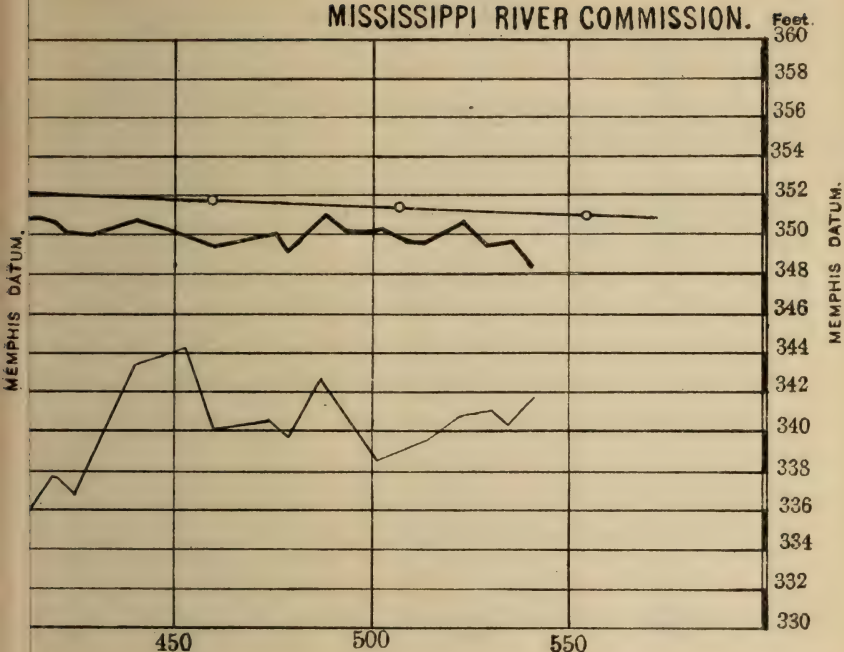
E. J. THOMAS,
Assistant Engineer.

To accompany my Annual Report for 1917:

Charles Smith
Major, Corps of Engineers, U.S. Army,
Secretary Mississippi River Commission.

Drawn by S. J. C., June, 1917.

MISSISSIPPI RIVER COMMISSION.



TWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.
 CAPE GIRARDEAU AND CLEAR CREEK LEVEE
 LEFT BANK 47 TO 60 MILES ABOVE CAIRO.

HORIZ. SCALE, FEET.

5,000

10,000

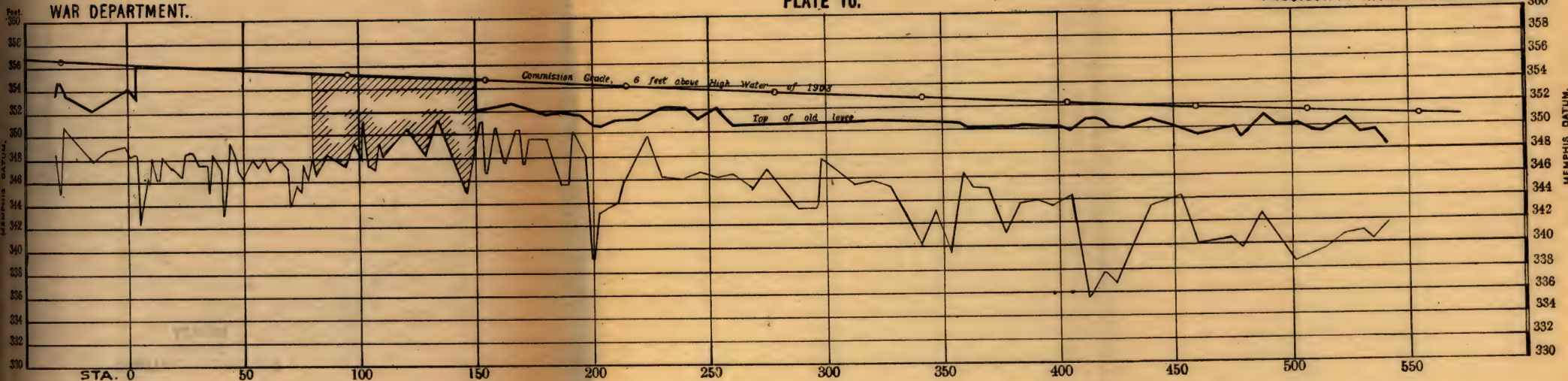
15,000

To accompany my Annual Report for 1917:

Charles Smith

Major, Corps of Engineers, U. S. Army,

Secretary Mississippi River Commission.

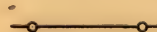


LEGEND.

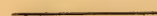
Top of Levee.



Established M.R.C. Grade.



Ground Line.



Enlarged by U.S. in 1916-17.



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.
EAST CAPE GIRARDEAU AND CLEAR CREEK LEVEE

LEFT BANK 47 TO 60 MILES ABOVE CAIRO.

HORIZ. SCALE, FEET.



Submitted:

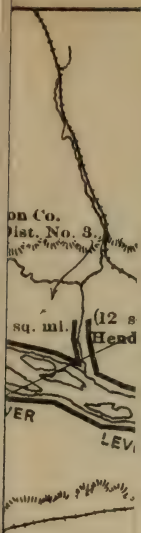
E. J. THOMAS,
Assistant Engineer.

Drawn by J. A. O'B.
June, 1917.

To accompany my Annual Report for 1917:

Charles Smith
Major, Corps of Engineers, U. S. Army,

Secretary Mississippi River Commission.



LEVEES BE

LC

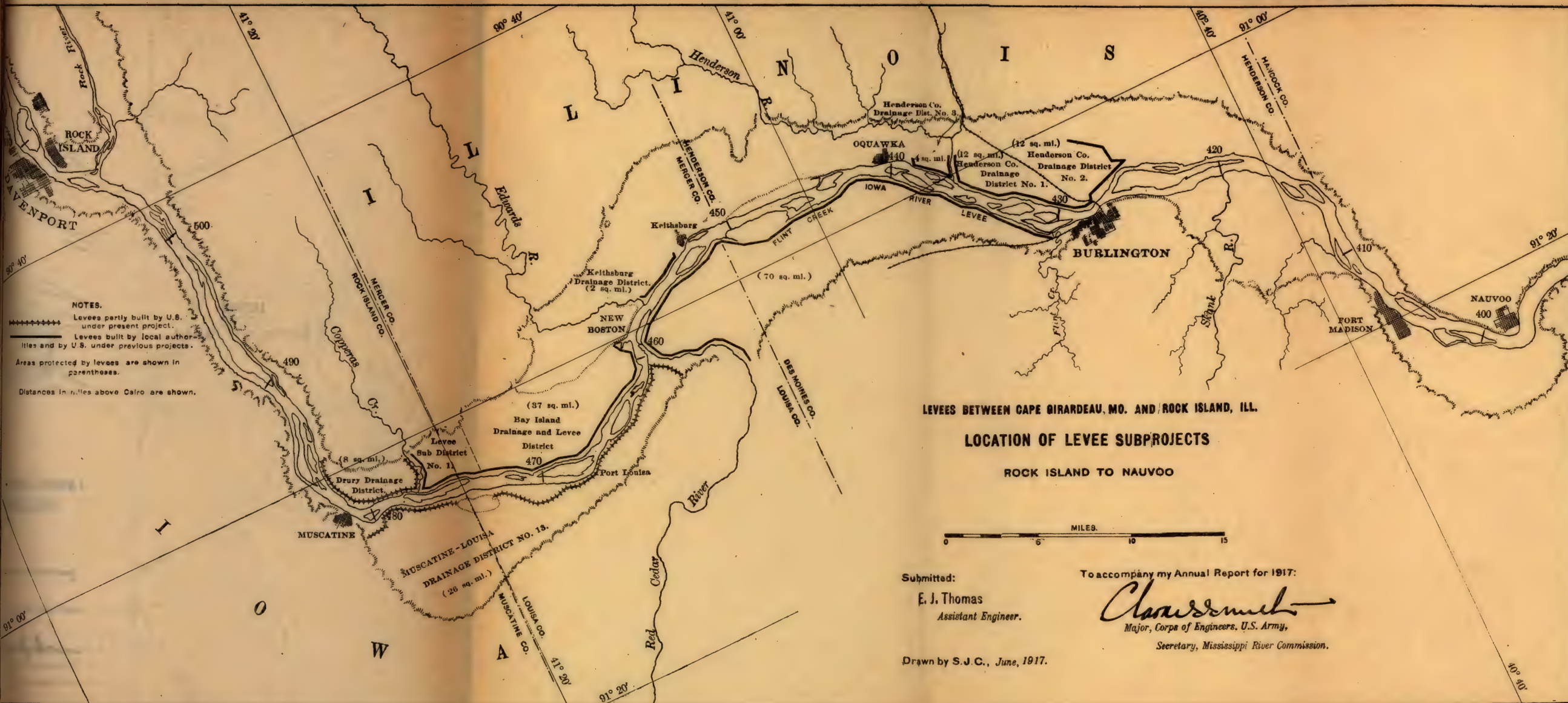
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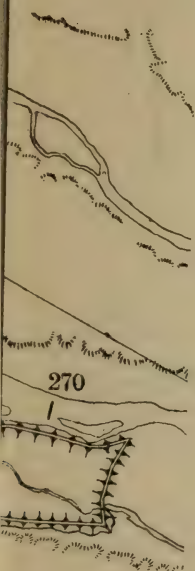
mitted:

E. J. Thoma

Assistant

wn by S. J.





D ROCK ISLAND, I ROJECTS N

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my Annual Repo

Edson
os of Engineers, U.S
ry, Mississippi Rive



Preston Levee
and Drainage District
(23 sq. mi.)

AND ROCK ISLAND
SUBPROJECTS
BES

10 15

any my Annual Repo

W. H. H. H.
Major, Corps of Engineers,
Secretary, Mississippi



bank revetment upon any part of the Mississippi River now under the jurisdiction of said commission, and in such manner as will best promote and accomplish the purposes for which commission was created, in so far as the territory hereby added to its said jurisdiction may be involved.

Any funds which are herein, or may hereafter be, appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended, under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, for levees upon any part of said river between Head of Passes and Rock Island, Illinois, in such manner as, in their opinion, shall best improve navigation and promote the interest of commerce at all stages of the river.

SEC. 6. That no part of the funds herein appropriated shall be used to pay for any work done by private contract if the contract price is more than twenty-five per centum in excess of the estimated cost of doing the work by Government plant.

Approved July 27, 1916.

[Public—No. 367—64th Congress.]

[H. R. 14777.]

AN ACT To provide for the control of the floods of the Mississippi River and of the Sacramento River, California, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for controlling the floods of the Mississippi River and continuing its improvement from the Head of the Passes to the mouth of the Ohio River the Secretary of War is hereby empowered, authorized, and directed to carry on continuously, by hired labor or otherwise, the plans of the Mississippi River Commission heretofore or hereafter adopted, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate \$45,000,000: *Provided*, That not more than \$10,000,000 shall be expended therefor during any one fiscal year.

(a) All money appropriated under authority of this section shall be expended under the direction of the Secretary of War in accordance with the plans, specifications, and recommendations of the Mississippi River Commission as approved by the Chief of Engineers, for controlling the floods and for the general improvement of the Mississippi River, and for surveys, including the survey from the Head of the Passes to the headwaters of the river, and a survey of the Atchafalaya Outlet so far as may be necessary to determine the cost of protecting its basin from the flood waters of the Mississippi River either by its divorcement from the Mississippi River or by other means, and for salaries, clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission.

(b) That no money appropriated under authority of this section shall be expended in the construction or repair of any levee unless and until assurances have been given satisfactory to the commission that local interests protected hereby will contribute for such construction and repair a sum which the commission shall determine to be just and equitable, but which shall not be less than one-half of such sum as may have been allotted by the commission for such work: *Provided*, That such contributions shall be expended under the direction of the commission, or in such manner as it may require or approve, but no contribution made by any State or levee district shall be expended in any other State or levee district except with the approval of the authorities of the State or district so contributing.

(c) Any funds which may hereafter be appropriated under authority of this act for improving the Mississippi River between the Head of the Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended upon any part of said river between the Head of the Passes and Rock Island, Illinois.

(d) No money appropriated under authority of this act shall be expended in payment for any right of way for any levee which may be constructed in cooperation with any State or levee district under authority of this act, but all such

rights of way shall be provided free of cost to the United States: *Provided*, That no money paid or expense incurred by any State or levee district in securing such rights of way, or in any temporary works of emergency during an impending flood, or for the maintenance of any levee line, shall be computed as a part of the contribution of such State or levee district toward the construction or repair of any levee within the meaning of paragraph (b) of this section.

That the watercourses connected with the Mississippi River to such extent as may be necessary to exclude the flood waters from the upper limits of any delta basin, together with the Ohio River from its mouth to the mouth of the Cache River, may, in the discretion of said commission, receive allotments for improvements now under way or hereafter to be undertaken.

Upon the completion of any levee constructed for flood control under authority of this act said levee shall be turned over to the levee district protected thereby for maintenance thereafter; but for all other purposes the United States shall retain such control over the same as it may have the right to exercise upon such completion.

* * * * *

GENERAL PROVISIONS.

SEC. 3. That all the provisions of existing law relating to examinations and surveys and to works of improvement of rivers and harbors shall apply, so far as applicable, to examinations and surveys and to works of improvement relating to flood control. And all expenditures of funds hereafter appropriated for works and projects relating to flood control shall be made in accordance with and subject to the law governing the disbursement and expenditure of funds appropriated for the improvement of rivers and harbors.

All examinations and surveys of projects relating to flood control shall include a comprehensive study of the watershed or watersheds, and the report thereon, in addition to any other matter upon which a report is required, shall give such data as it may be practicable to secure in regard to (a) the extent and character of the area to be affected by the proposed improvement, (b) the probable effect upon any navigable water or waterway, (c) the possible economical development and utilization of water power, and (d) such other uses as may be properly related to or coordinated with the project. And the heads of the several departments of the Government may, in their discretion, and shall upon the request of the Secretary of War, detail representatives from their respective departments to assist the Engineers of the Army in the study and examination of such watersheds, to the end that duplication of work may be avoided and the various services of the Government economically coordinated therein: *Provided*, That all reports on preliminary examinations hereafter authorized, together with the report of the Board of Engineers for Rivers and Harbors thereon and the separate report of the representative of any other department, shall be submitted to the Secretary of War by the Chief of Engineers, with his recommendations, and shall be transmitted by the Secretary of War to the House of Representatives, and are hereby ordered to be printed when so made.

In the consideration of all works and projects relating to flood control which may be submitted to the Board of Engineers for Rivers and Harbors for consideration and recommendation, said board shall, in addition to any other matters upon which it may be required to report, state its opinion as to (a) what Federal interest, if any, is involved in the proposed improvement; (b) what share of the expense, if any, should be borne by the United States; and (c) the advisability of adopting the project.

All examinations and reports which may now be made by the Board of Engineers for Rivers and Harbors upon request of the Committee on Rivers and Harbors relating to works or projects of navigation shall in like manner be made upon request of the Committee on Flood Control on all works and projects relating to flood control.

SEC. 4. That the salary of the civilian members of the Mississippi River Commission shall hereafter be \$5,000 per annum.

Approved, March 1, 1917.

[Public, No. 21—65th Congress.]

[H. R. 11.]

AN ACT Making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, nineteen hundred and eighteen, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums are appropriated,

out of any money in the Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, nineteen hundred and eighteen, namely:

* * * * *

ENGINEER DEPARTMENT.

For prosecuting work of flood control in accordance with the provisions of the flood-control act approved March first, nineteen hundred and seventeen, \$6,000,000.

* * * * *

Approved, June 12, 1917.

APPENDIX 2.

IMPROVING MISSISSIPPI RIVER, FIRST AND SECOND DISTRICTS.

The first district extends from Cape Girardeau, Mo., to the foot of Island 40, a distance of 270 miles. The second district extends from foot of Island 40 to the mouth of White River, a distance of 173 miles.

District headquarters: Memphis, Tenn.

District officer: Lieut. Col. G. P. Howell, Corps of Engineers, United States Army.

WORKS.

I. Revetments:

- (a) Columbus, Ky.
- (b) Hickman, Ky.
- (c) Slough Landing Neck, Tenn.
- (d) New Madrid, Mo.
- (e) Gayoso Bend, Mo.
- (f) Caruthersville, Mo.
- (g) Barfield, Ark.
- (h) Plum Point Reach, Ark. and Tenn.
- (i) Golden Lake, Ark.
- (j) Hopefield Bend, Ark.
- (k) Memphis Harbor, Tenn.
- (l) Star Landing, Miss.
- (m) Porter Lake, Ark.
- (n) Walnut Bend, Ark.

I. Revetments—Continued.

- (o) Trotters, Miss.
- (p) Helena, Ark.
- (q) Delta, Miss.
- (r) Oldtown, Ark.
- (s) Sunflower, Miss.

II. Experimental revetment.

III. Wolf River.

IV. Levees:

- (a) Upper St. Francis district.
- (b) Reelfoot district.
- (c) Lower St. Francis district.
- (d) Upper Yazoo district.
- (e) White River district.

V. Surveys.

VI. Plant.

I. REVETMENTS.

(a) *Columbus, Ky.*

Location.—Twenty-one miles below Cairo, left bank.

Original condition.—For some years prior to 1890 the river bank in front of Columbus was subjected to more or less active caving, finally resulting in the necessity of fixing the channel and of preventing further encroachment upon the town, whose river-front property was already in close proximity to the bank.

Previous projects.—None.

Existing project.—The existing project was adopted in 1889 and contemplated the installation of submerged revetment dikes along the Columbus front.

Operations and results prior to the fiscal year.—During the years 1889 and 1890 five submerged revetment dikes were placed about 500 feet apart, at a total cost of \$43,750.

The result has been a stable bank in this locality throughout the interval between extreme dikes; namely, 2,200 feet, and for a considerable distance below the downstream dike.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—All dikes are in effective condition and suggest no probable need of further expenditure.

Local cooperation.—None.

Effect of improvement.—The river channel in the vicinity of Columbus has been fixed, and the town protected from its further encroachments. The bank between dikes and for some distance below has been maintained.

Proposed operations.—None.

(b) *Hickman, Ky.*

Location.—Thirty-six miles below Cairo, left bank.

Original condition.—Throughout the eighties active caving was in progress along the Hickman River front, to the extent that in the year 1889 it became necessary to initiate revetment for the maintenance of the Hickman Harbor and for the protection of its river-front property.

Previous projects.—None.

Existing project.—The existing project, adopted in 1889, provided for the revetment of the caving bank, to the end of holding the river channel in its then position and of preventing threatened destruction of town property.

Operations and results prior to the fiscal year.—About 1,400 feet of continuous standard fascine revetment were installed in 1889, 1892, and 1894. The total expenditure has amounted to \$95,132, of which \$92,595.46 pertained to new construction and \$2,536.54 to repairs.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The revetment throughout is in good condition. No change of any consequence has occurred since last report.

Local cooperation.—None.

Effect of improvement.—The town of Hickman has been guarded against serious property loss; its river slope has been made stable and the channel, in front of the town, has been permanently located.

Proposed operations.—None.

(c) *Slough Landing Neck, Tenn.*

Location.—Sixty-eight to eighty miles below Cairo, left bank.

Original condition.—This is a long, narrow point of land around which the Mississippi River flows, making acute bends on the upper and lower sides. Active bank caving had been in progress in both bends for a number of years, resulting in a progressive diminution of the distance across the neck. Moreover, incident to the extreme floods of 1912 and 1913, marked surface scour developed from rapid crossflow, thereby bringing into question a serious hazard of cut-off, the effect of which would be a disturbance of river conditions over a period of years and for many miles above and below the neck.

Previous projects.—None.

Existing project.—The existing project was adopted in 1913 to eliminate the danger of cut-off by the revetment of the bends to prevent further bank loss and by the construction of a levee or dike along the neck to check crossflow and surface scour during the higher river stages.

Operations and results prior to the fiscal year.—The work accomplished prior to the present year consisted in the installation in the upstream bend of standard willow fascine revetment and upper bank pavement. This resulted in the protection against further erosion of 15,600 linear feet of bank, at a cost of \$634,150.65 for new work and \$9,885.35 for repairs.

In addition to the foregoing a levee or dike about 8 miles in length, containing 849,541 cubic yards, was constructed along the axis of the neck, at a cost of \$112,100, with the object of preventing continued surface cut-off.

Operations and results during the fiscal year.—The revetment of the upper bend has been extended downstream for a distance of 764 feet, and in addition the upper bank along a stretch of about 1,200 feet of the last season's work was paved. The work was in progress at the end of the last fiscal year and completed on July 18, 1916, when the plant was towed to Gayoso, Mo., for operation at that point.

The foregoing operations were accomplished by hired labor with Government plant at a total cost of \$45,205.18.

The following table gives detailed costs:

SLOUGH LANDING NECK (68 L.), FIRST AND SECOND DISTRICTS.

Mattresses, total area, 2,106 squares; channel mats, 91 per cent; connecting mats, 9 per cent.

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$300.00		\$0.143
1/4-inch strand.....pounds..	13,000	903.25	6.172	.429
1/4-inch strand.....do.....	4,400	241.00	2.089	.115
1/4-inch strand.....do.....	14,800	946.20	7.027	.449
Wire, No. 9.....do.....	5,800	218.80	2.754	.104
Wire, silicon Br.....do.....	400	82.00	.19	.039
Staples.....do.....	400	13.00	.19	.006
Clips, 1/2-inch.....number..	950	107.00	.451	.051
Clips, 1/2-inch.....do.....	900	57.40	.427	.027
Brush and poles.....cords..	3,196	4,794.45	1.517	2.277
Rope, manilla.....pounds..	5,200	942.00	2.469	.447
Miscellaneous expenses.....		175.30		.083
Subsistence.....		3,501.00		1.662
Steamboat expenses.....		1,090.50		.518
Labor.....		7,045.43		3.345
Supervision.....		525.00		.249
Total.....		20,942.33		9.944
Total field cost.....		20,942.33		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$65.00		\$0.031
Stone.....tons..	1,300	2,371.00	0.617	1.126
Rope, manilla.....pounds..	1,372	249.90	.651	.119
Miscellaneous expenses.....		58.16		.028
Subsistence.....		550.48		.261
Steamboat expenses.....		140.00		.066
Labor.....		1,090.40		.518
Supervision.....		85.00		.040
Total.....		4,609.94		2.189
Total field cost.....		4,609.94		

Paving (concrete, 791 squares; stone, 762 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$270.00		\$0.174
Stone.....tons..	1,130	2,610.03	0.921	1.681
Rope, manilla.....pounds..	3,900	706.00	2.511	.454
Cement.....sacks..	3,500	1,317.50	2.254	.868
Sand and gravel.....cubic yards..	1,120	257.60	.721	.166
Coal.....tons..	60	150.00	.039	.096
Oil.....		15.00		.010
Miscellaneous expenses.....		150.00		.096
Subsistence.....		2,285.00		1.471
Steamboat expenses.....		950.00		.612
Labor.....		4,960.00		3.194
Supervision.....		415.00		.207
Total.....		11,116.13		9.080
Total field cost.....		11,116.13		

Summary of costs (764 linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total.	Total cost per linear foot. ¹
	Per square.	Total.	Per square.	Total.		
Total field cost.....	\$12. 133	\$25, 552. 27	\$9. 089	\$14, 116. 13	\$39, 668. 40	\$39. 29
Surveys.....	. 127	267. 00	. 095	147. 51	414. 51	. 41
Care of plant.....	. 248	522. 16	. 186	288. 53	810. 69	. 80
Repair of plant.....	. 596	1, 255. 03	. 446	693. 38	1, 948. 41	1. 93
Depreciation of plant.....	. 723	1, 522. 27	. 542	840. 90	2, 363. 17	2. 34
Total.....	13. 827	29, 118. 73	10. 358	16, 086. 45	45, 205. 18	44. 77

¹ Includes the cost of completing mattresses and paving along 1,200 feet of last season's work.

Cost of completing last season's work.

Total field cost.....	\$9, 650. 20
Surveys.....	100. 88
Care of plant.....	197. 2
Repair of plant.....	474. 4
Depreciation of plant.....	574. 6
Total.....	10, 997. 3

Condition at the end of fiscal year.—About 80 per cent of the revetment required on the upper side of the neck is completed. The work is in excellent condition. Bank caving has definitely ceased throughout the length of bend where caving was most active. Caving, however, is in progress from the downstream end of the work for a distance of about 4,000 feet.

The levee, or dike, longitudinally of the neck, has effectively eliminated the question of cross flow, and consequent surface scour.

Local cooperation.—None.

Effect of improvement.—The heretofore caving bend has been stabilized. The point of the confronting reef has moved downstream correspondingly. In conjunction with the levee, or dike, constructed throughout the length of the neck the threatened cut-off of the river across the latter has been obviated.

Proposed operations.—Extension, downstream, for a distance of about 4,000 feet will probably have to be made during the next two or three years unless the caving ceases or decreases materially in rate.

The necessity, or the contrary, for revetment on the lower side of the neck will depend wholly upon the further development of river conditions in the vicinity. Present indications point strongly to the probability that the main draw of the river will leave the caving bend, and that its revetment will therefore not be required.

(d) New Madrid, Mo.

Location.—Seventy-one miles below Cairo, right bank.

Original condition.—New Madrid is located at the head of a sharp bend of the river, opposite Watsons Point or Slough Landing Neck. The bank in front of the town had eroded for a number of years to the point that, in 1893, it was determined to be necessary to install revetment in order to fix the curvature of the river in this vicinity and to guard the town against its further inroads.

Previous projects.—None.

Existing project.—The existing project, dating from 1893, had in view the construction of a sufficient length of standard fascine revetment to stabilize river and bank conditions along the New Madrid front.

Operations and results prior to the fiscal year.—During the years 1893, 1896, 1898, and 1900 revetment was placed to the aggregate length of 4,450 feet at a total cost of \$153,000.

The result has been a stable bank for the length given and throughout the balance of the downstream bend.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The entire work is in excellent condition.

Local cooperation.—None.

Effect of improvement.—The curvature of the stream throughout the New Madrid Bend has been fixed, the front of the town made secure, and the destruction of its river-front property prevented.

Proposed operations.—None.

(e) *Gayoso Bend, Mo.*

Location.—One hundred and six miles below Cairo, right bank.

Original condition.—Caving in Gayoso Bend has been quite active for a number of years, and had progressed until the river bank was in such dangerous proximity to the controlling levee line that the United States constructed a levee loop around the most threatened point in 1914. This loop was extended downstream by the local levee board during 1915-16. A further retirement of the levee was deemed inadvisable on account of low and swampy country behind the existing levee, which would render levee construction unduly costly; hence, protection by revetment was authorized at the joint cost of the Federal Government and local levee district.

Previous projects.—None.

Existing project.—Adopted in 1916; contemplates the protection of the levee in this bend by the installation of standard fascine revetment.

Operations and results prior to the fiscal year.—None.

Operations and results during the fiscal year.—Operations consisted in the installation of 5,578 feet of standard fascine channel mattresses. Grading and paving along this stretch, however, have not been fully completed. The work was commenced on July 27, 1916, but was suspended on January 6, 1917, on account of high water; operations were resumed on May 2, and are still in progress.

The season's work was seriously handicapped throughout the season by the scarcity of brush and labor and unsuitable river stages during the latter part of the season.

The foregoing operations were accomplished by hired labor with Government plant at a total cost of \$210,500.

The following table gives details of cost:

GAYOSO BEND, MO. (106 E.) FIRST AND SECOND DISTRICTS.

Mattresses, total area, 14,820 square (channel mats, 98 per cent; connecting mats, 2 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$254.00		\$0.017
1-inch strand.....pounds..	92,000	6,393.75	6.208	.431
1/2-inch strand.....do.....	33,500	1,832.75	2.280	.124
1/4-inch strand.....do.....	121,000	7,742.00	8.164	.522
Wire No. 9.....do.....	45,000	1,696.75	3.037	.114
Wire silicon Br.....do.....	2,900	594.50	.196	.040
Staples.....do.....	3,200	100.20	.216	.007
Clips 1/2 inch.....number.....	6,050	677.60	.408	.046
Clips 1/4 inch.....do.....	6,100	389.00	.412	.026
Brush and poles.....cord.....	19,291	30,573.84	1.302	2.063
Rope, manilla.....pounds..	10,465	1,901.20	.706	.128
Miscellaneous expenses.....		297.83		.020
Subsistence.....		19,990.49		1.349
Steamboat expenses.....		13,125.00		.886
Labor.....		27,988.11		1.889
Supervision.....		5,924.50		.400
Total.....		119,483.52		8.062
Total field cost.....		119,483.52		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$127.00		\$0.009
Stone.....tons.....	10,176	20,355.05	0.687	1.373
Rope, manilla.....pounds..	4,186	760.48	.282	.051
Miscellaneous expenses.....		75.00		.005
Subsistence.....		2,240.30		.151
Steamboat expenses.....		1,260.20		.085
Labor.....		3,109.80		.210
Supervision.....		720.00		.049
Total.....		28,647.83		1.933
Total field cost.....		28,647.83		

Grading, 2,890 squares.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$63. 50		\$0. 022
Rope, manilla..... pounds.....	2, 093	380. 24	0. 724	. 132
Coal..... tons.....	357	892. 77	. 124	. 310
Oil.....		47. 16		. 016
Miscellaneous expenses.....		229. 74		. 079
Subsistence.....		761. 90		. 263
Steamboat expenses.....		160. 00		. 055
Labor.....		1, 959. 50		. 678
Supervision.....		225. 00		. 078
Total.....		4, 719. 81		1. 633
Total field cost.....		4, 719. 81		

Paving (stones, 2,185 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$190. 50		\$0. 087
Stone..... tons.....	8, 183	16, 368. 70	3. 745	7. 492
Rope, manilla..... pounds.....	4, 186	760. 48	1. 916	. 348
Miscellaneous expenses.....		125. 00		. 057
Subsistence.....		2, 550. 40		1. 167
Steamboat expenses.....		2, 550. 50		1. 167
Labor.....		5, 100. 80		2. 335
Supervision.....		1, 125. 50		. 515
Total.....		28, 771. 88		13. 168
Total field cost.....		28, 771. 88		

Summary of costs (5,164 linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total. ¹
	Per square.	Total	Per square.	Total.	
Total field cost.....	\$9. 995	\$148, 131. 35	\$14. 801	\$33, 491. 69	\$181, 623. 04
Office expenses.....	. 144	2, 124. 50	. 214	484. 94	2, 609. 44
Surveys.....	. 036	535. 05	. 054	122. 11	657. 16
Care of plant.....	. 223	3, 300. 28	. 332	753. 17	4, 053. 45
Repair of plant.....	. 535	7, 931. 85	. 800	1, 810. 22	9, 742. 07
Depreciation of plant.....	. 649	9, 620. 28	. 970	2, 195. 55	11, 815. 83
Total.....	11. 582	171, 643. 31	17. 171	38, 857. 68	210, 500. 99

¹ Not completed on account of interruption by high water.

Condition at the end of fiscal year.—Caving continues upstream from the upper end of the revetment. The work should be extended upstream in order to fully protect the levee in this bend.

Local cooperation.—The St. Francis Levee Board of Missouri contributed \$150,000 toward the cost of this work.

Effect of improvement.—The revetment placed has resulted in stabilizing of the river bank and the protection of the levee.

Proposed operations.—Extension upstream for about 2,000 feet with the available balance. A further upstream extension of about 6,000 feet will probably be required.

(f) Caruthersville, Mo.

Location.—One hundred and ten miles below Cairo, right bank.

Original condition.—Prior to 1898 the river in this vicinity had approached the town of Caruthersville, to the point of requiring that the town front be revetted as the alternative to the serious destruction of its property and levee. It was desirable as well to hold this point as an assistance in fixing the banks, both above and below, where, for some distance, the controlling levee was quite close to the river.

Previous projects.—None.

Existing project.—The existing project provided for the holding of the Caruthersville point in the interest of channel and bank conditions in the locality, and dates from the year 1898. It contemplated the construction of a spur dike and sufficient fascine revetment to effect the purpose outlined.

Operations and results prior to the fiscal year.—From 1898 to 1903 one spur revetment dike and 2,400 feet of continuous fascine revetment were placed immediately in front of the town at a cost of \$72,173.91. Repairs since 1903 have cost \$2,072.25, making a total expenditure at Caruthersville of \$74,245.16.

The result of the work outlined has been the control of the confronting channel and of the river banks in the vicinity.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The work is in excellent condition throughout.

Local cooperation.—None.

Effect of improvement.—The improvement has resulted in the prevention of further bank erosion, in the fixing of river conditions in the vicinity, and in guarding the town of Caruthersville and adjacent levees from serious destruction.

Proposed operations.—None.

(g) Barfield, Ark.

Location.—One hundred and forty-one miles below Cairo, right bank.

Original condition.—Caving has been very active from River Styx to Barfield Landing; at the latter point the controlling levee was breached. The topographical features of the country adjacent to the levee were such that to rebuild the levee on a location sufficiently remote from the caving bank to insure anything like a reasonable length of life, would be unduly expensive; therefore, protection by the installation of bank revetment was authorized with the understanding that the local levee board would construct a levee loop round the breach in the levee at Barfield Landing, Ark.

Previous projects.—None.

Existing project.—Adopted in 1916; contemplates the protection of the levee in this vicinity by the installation of standard revetment.

Operations and results prior to the fiscal year.—None.

Operations and results during the fiscal year.—Consisted in the installation of 3,475 feet of revetment. The work was commenced on September 18, 1916, but was suspended on account of high water on March 6, 1917. Operations were resumed on April 26, 1917, and are still in progress.

The season's work was seriously handicapped throughout the season by the scarcity of brush and labor and unfavorable river stages during the latter part of the season.

The foregoing operations were accomplished by hired labor with Government plant at a total cost of \$155,351.09.

The following table gives detailed costs:

3512 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

BARFIELD, ARK. (141 R.), FIRST AND SECOND DISTRICTS.

Mattresses, total area, 10,627 squares (channel mats, 82 per cent; connecting mats, 18 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total Cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$480.00		\$0.045
1/2-inch strand.....pounds..	56,300	3,912.75	5.298	.368
3/4-inch strand.....do.....	23,000	1,259.00	2.164	.118
1/2-inch strand.....do.....	71,000	4,543.00	6.680	.427
Wire No. 9.....do.....	26,000	980.40	2.445	.092
Wire silicon.....do.....	1,600	328.00	.150	.031
Staples.....do.....	2,400	75.80	.226	.007
Clips, 1/2-inch.....number..	3,750	411.00	.353	.039
Clips, 3/4-inch.....do.....	3,600	229.50	.339	.022
Brush and poles.....cords..	15,529	26,777.83	1.461	2.520
Rope, manila.....pounds..	8,422	1,529.45	.792	.144
Miscellaneous expenses.....		1,438.99		.135
Subsistence.....		12,668.23		1.192
Steamboat expenses.....		11,981.87		1.128
Labor.....		18,995.96		1.787
Supervision.....		3,900.00		.367
Total.....		89,511.78		8.422
Total field cost.....		89,511.78		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$240.00		\$0.02
Stone.....tons..	8,190	16,386.90	0.770	1.54
Rope, manila.....pounds..	3,368	611.78	.317	.05
Miscellaneous expenses.....		359.75		.03
Subsistence.....		1,811.40		.17
Steamboat expenses.....		1,090.50		.10
Labor.....		2,494.06		.23
Supervision.....		550.00		.05
Totals.....		23,544.39		2.21
Total field cost.....		23,544.39		

Grading (2,960 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$120.00		\$0.04
Rope, manila.....pounds..	1,685	305.89	0.570	.10
Coal.....tons..	242	605.62	.082	.20
Oil.....		29.20		.01
Miscellaneous expenses.....		313.47		.10
Subsistence.....		621.00		.21
Steamboat expenses.....		175.00		.05
Labor.....		1,535.76		.50
Supervision.....		175.00		.05
Total.....		3,880.94		1.3
Total field cost.....		3,880.94		

Paving (concrete, 592 squares; stone, 893 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
obilization and demobilization.....		\$360.00		\$0.242
one.....tons.....	1,849	3,700.08	1.245	2.492
ope, manila.....pounds.....	3,369	611.78	2.270	.412
ement.....sacks.....	3,410	1,619.60	2.296	1.091
ind and gravel.....cubic yards.....	812	178.64	.547	.120
al.....tons.....	30	135.00	.020	.091
il.....		12.00		.008
iscellaneous expenses.....		225.00		.151
bsistence.....		2,150.00		1.448
eamboat expenses.....		2,425.00		1.633
abor.....		4,571.86		3.079
ipervision.....		375.00		.252
Total.....		16,363.96		11.019
Total field cost.....		16,363.96		

Summary of costs (3,475 linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total.	Total cost per linear foot.
	Per square.	Total.	Per square.	Total.		
Total field cost.....	\$10.637	\$113,056.17	\$12.330	\$20,244.90	\$133,301.07	\$38.36
rice expenses.....	.179	1,894.69	.206	338.09	2,232.78	.64
rveys.....	.028	299.20	.032	53.40	352.60	.10
ire of plant.....	.246	2,614.08	.284	466.55	3,080.63	.89
epair of plant.....	.592	6,282.58	.683	1,121.40	7,403.98	2.13
epreciation of plant.....	.717	7,620.03	.828	1,360.00	8,980.03	2.58
Total.....	12.399	131,766.75	14.363	23,584.34	155,351.09	44.70

Condition at the end of fiscal year.—Caving continues above, below, and in the gap between the revetment. The revetted bank has been stabilized.

Local cooperation.—None.

Effect of improvement.—The effect of the revetment placed has resulted in the prevention of further loss of levee where the river bank had receded to within 150 feet of the levee during the low-water period of 1916.

Proposed operations.—Placing of about 1,500 feet of revetment with the balance available, and an additional 10,000 feet as the necessary funds therefor become available.

(h) Plum Point Reach, Ark. and Tenn.

Location.—One hundred and forty-seven to one hundred and eighty-five miles below Cairo.

Original condition.—In accordance with the first plans of the commission, instruction operations were limited to two reaches of the river where navigation difficulties were the most pronounced. The upper one, known as Plum Point Reach, covered the river from the head of Island 26, 147 miles below Cairo, to Randolph, Tenn., a distance of 38 miles. In this reach channel depths of 4½ to 6 feet were frequently reported. The early construction work was limited to the stretch between Ashport, Tenn., 153 miles below Cairo, and Fullerton towhead, a distance of 15 miles.

The width of the river between the high-water banks in this reach was largely in excess of the average, being 10,000 feet for much of its length, which resulted in shallow shifting channels.

Previous project.—To correct this condition works were inaugurated in 1881, providing for contraction of the low-water channel to a width of 3,000 feet,

this to be accomplished by means of permeable pile dikes, the closure of chutes behind towheads and islands, and the revetment of caving banks.

The development of hydraulic dredges and their success in maintaining temporary channels of ample depth during the low-water periods resulted, in 1895, in the suspension of channel contraction work, and since that date work has been confined to repairs to revetments.

Existing project.—Repairs to revetments.

Operations and results prior to the fiscal year.—Funds for construction work under the commission were first made available by the river and harbor act of March 3, 1881.

Under this project, revetment was placed in Ashport Bend (153 L.), Fletchers Bend (159 R.), Osceola Bar (162 R.), Bullerton towhead (168 R.); a total of about 5 miles. All of this early work consisted of woven mats, 100 to 140 feet in width, two-thirds of which failed owing to limited width and defective construction. The revetment along Bullerton towhead (9,650 feet in length) held the bank line until later covered by fascine mats 260 feet wide, which are still in place.

Permeable pile dikes were placed at Gold Dust (157 L.), to cut off flow through Elmot Chute; Osceola dikes (162 R.), to cut off the flow between Osceola Bar and the Arkansas bank; Bullerton dikes (167 R.), to close the channel behind Bullerton towhead; Plum Point dikes (167 L.), to contract the channel and concentrate the flow between Bullerton towhead and the Tennessee shore below Plum Point.

These dikes generally accomplished the purpose for which they were constructed.

From 1885 to 1888 lack of appropriations and restrictions imposed by law as to the character of work prevented necessary maintenance and extensions; and this, together with the flimsy character of construction incident to experimental work, resulted in general failure of the structures described. The work installed did, however, have a decided influence in channel depths throughout the reach.

The commission report of 1891 states:

"The least depth found in the improved part of the reach was 12 feet. The favorable results heretofore reported were maintained. The depth since the works were begun having doubled, the navigable capacity of this portion of the stream has been multiplied by 8."

In general terms it may be said that little difficulty has been experienced in navigating the reach since the contraction works approached completion.

Total expenditures to June 30, 1895, \$4,246,264.70.

Since 1895 there has been expended on repairs to the several revetments \$1,103,108.50.

Operations and results during the fiscal year.—During the year 2,960 linear feet of standard fascine channel mat has been installed in upstream extension of the last season's work and 4,300 linear feet of upper bank work along the last season's work. Operations commenced June 1, 1916, but were interrupted by high water from June 15 to July 12, 1916. Work was resumed on July 13 and continued until August 9, when the plant was moved to Wolf River, Tenn., to place foundation mattresses for the dam across that stream. The plant was moved back to Bullerton Bar, Ark., and operations resumed on September 1, 1916. Work was suspended again on account of high water from January 9 to 22, 1917. Work was resumed on January 23 and completed March 8, 1917.

The work described has been carried on by hired labor with Government plant, at a total expenditure of \$164,104.32.

The following table shows detailed costs:

BULLERTON BAR, ARK. (168 R.), FIRST AND SECOND DISTRICTS.

attresses, total area, 10,216 squares (channel mats, 72 per cent; connecting mats, 28 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$180.00		\$0.018
1/2 inch strand.....pounds..	53,400	3,711.20	5.227	.363
1/2 inch strand.....do.....	26,099	1,428.00	2.555	.140
1/2 inch strand.....do.....	66,719	4,269.00	6.531	.418
Re No. 9.....do.....	33,300	1,255.60	3.259	.123
Re, silicon bronze.....do.....	1,500	307.50	.147	.030
Pls.....do.....	2,300	72.75	.225	.007
Pls, 1/2-inch.....number..	3,950	443.40	.387	.043
Pls, 1/2-inch.....do.....	3,700	236.00	.362	.023
Pls and poles.....cords..	13,883	23,090.35	1.360	2.260
Re, manila.....pounds..	6,279	1,140.22	.615	.112
Miscellaneous expenses.....		447.76		.044
Assistance.....		13,150.07		1.287
Samboat expenses.....		7,929.48		.776
Door.....		17,110.13		1.675
Supervision.....		2,649.00		.259
Total.....		77,420.46		7.578
Total field cost.....		77,420.46		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$90.00		\$0.009
Re.....tons..	7,167	12,987.17	0.702	1.271
Re, manila.....pounds..	2,512	456.09	.246	.045
Miscellaneous expenses.....		149.25		.015
Assistance.....		1,910.20		.187
Samboat expenses.....		990.00		.097
Door.....		2,449.20		.239
Supervision.....		443.00		.043
Total.....		19,474.91		1.906
Total field cost.....		19,474.91		

Grading. (2,799 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$45.00		\$0.016
Re, manila.....pounds..	1,256	228.04	0.449	.081
Re.....tons..	162	405.00	.058	.145
Pls.....do.....		17.49		.006
Miscellaneous expenses.....		303.06		.108
Assistance.....		437.50		.156
Samboat expenses.....		125.00		.045
Door.....		1,144.20		.409
Supervision.....		148.00		.053
Total.....		2,853.29		1.020
Total field cost.....		2,853.29		

Paving (stone, 4,250 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$135.00		\$0.032
Stone..... tons.....	11,735	21,350.70	2.761	5.024
Rope, manila..... pounds.....	2,511	456.09	.591	.107
Miscellaneous expenses.....		275.25		.065
Subsistence.....		4,150.75		.977
Steamboat expenses.....		3,250.00		.765
Labor.....		11,550.40		2.718
Supervision.....		1,620.00		.381
Total.....		42,788.19		10.009
Total field cost.....		42,788.19		

Summary of costs (2,960 linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total.	Total costs per linear foot. ¹
	Per square.	Total.	Per square.	Total.		
Total field cost.....	\$9.484	\$96,895.37	\$11.089	\$45,641.48	\$142,536.85	\$36.5
Office expenses.....	.022	224.16	.025	102.69	326.85	.01
Surveys.....	.050	515.46	.057	236.08	751.54	.11
Care of plant.....	.218	2,223.98	.248	1,018.78	3,242.76	.8
Repair of plant.....	.523	5,345.12	.594	2,448.54	7,793.66	2.0
Depreciation of plant.....	.632	6,451.45	.729	3,001.21	9,452.66	2.4
Total.....	10.929	111,655.54	12.742	52,448.78	164,104.32	42.0

¹ Includes the cost of completing connecting mattresses and paving along 4,300 feet of last season's work.

Cost of completing last season's work.

Total field cost.....	\$34,485.10
Office expenses.....	76.8
Surveys.....	176.6
Care of plant.....	762.0
Repair of plant.....	1,831.5
Depreciation of plant.....	2,221.4
Total.....	39,553.4

Condition at the end of fiscal year.—The revetment works throughout Plum Point Reach are generally in effective condition, with the exception of that at the lower end of Ashport Bend, which was flanked some years since. During the present fiscal year there has been a further small loss at the lower end of the work by flanking, which, however, does not affect the effectiveness of the work as a whole.

High-water attack continues upstream from the upstream end of the new Bullerton Bar revetment and the old work at the downstream end, where a pocket cave developed during the last high water, resulting in the loss of about 700 feet of the old work.

The stone and brush dam at the head of chute of Island 30 has been destroyed, as heretofore reported, for a width of 1,300 feet near its center and flanked around its western end. The main draw of the river continues with additional loss through and around this dam and with enlargement of the chute of Island 30.

Local cooperation.—None.

Effect of improvement.—The channel throughout Plum Point Reach has been rendered more stable and its depth materially increased. Bank caving has been prevented throughout the length of the several revetments, and the Arkansas Levee from Fletchers Bend to near Bullerton has been thus protected, as have also the towns of Luxora and Osceola, Ark.

Proposed operations.—It will be necessary to extend the work upstream for about 4,000 feet and replace the 700 feet of old work destroyed during the last high water.

(i) *Golden Lake, Ark.*

Location.—One hundred and ninety-two miles below Cairo, right bank.

Original condition.—Caving had been in progress for many years prior to 1911. In the bend of Golden Lake the levee line had been located between the river and a large area of low, marshy ground to the rear. Its relocation would therefore have been both difficult and costly. The river had attained such proximity to the said levee line by 1911 as to require that the river channel be stabilized and further caving be prevented by the installation of revetment.

Previous projects.—None.

Existing project.—Adopted in 1911; had in view the prevention by bank revetment of further erosion in order that the channel might be held in definite position, the existing levee line maintained, and the construction of a costly levee loop around Golden Lake obviated.

Operations and results prior to the fiscal year.—During the years 1911 and 1912, 3,000 feet of standard fascine revetment were installed, at a total cost of \$101,492.98.

This work resulted in making essentially stable channel and bank conditions throughout Golden Lake bend, though somewhat active caving has been in progress for the past several years at the lower end thereof.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The revetment is in good condition, with the exception that a pocket cave has set up at its lower end, with some loss of upper bank paving. This condition is of relatively small consequence for the present, and no evidence exists that it will require any attention for several years.

Local cooperation.—None.

Effect of improvement.—Bank caving throughout the length and in the vicinity of the revetment has been stopped and the existing levee line maintained, thereby avoiding the necessity and expense of a costly levee loop around Golden Lake. The channel has been held to position throughout the bend.

Proposed operations.—None.

(j) *Hopefield Bend, Ark.*

Location.—Two hundred and twenty-seven miles below Cairo, right bank.

Original condition.—The old course of the river in this locality crossed from the Tennessee shore above Memphis in a long sweep to the Arkansas shore, hence by an acute bend back to the Tennessee shore in the vicinity of Memphis. This situation involved persistent and finally very active caving from about Mound City, Ark., downstream to Hopefield Point. It became evident about 1880 that continued loss of bank throughout the stretch of river in question would seriously damage, if not destroy, the important harbor of Memphis.

Previous projects.—None.

Existing project.—Adopted in 1882; contemplated the revetment of the bend between Hopefield and Mound City to the extent necessary to hold the river in its then course and to thus maintain the harbor of Memphis.

Operations and results prior to the fiscal year.—Beginning in the year 1882 a total of 16,600 feet of woven willow revetment was placed, to and including the year 1889, at a total cost of \$836,000. The river and harbor act of 1886 prohibited "works of bank protection or revetment." This restriction prevented the extension of the work as contemplated and resulted in the loss of nearly a mile of revetment and a recession of Hopefield Point, amounting to over 3,000 feet before renewal of the work was authorized. The woven willow mattress proved ineffective and was replaced between the years 1893 and 1906, with standard fascine revetment construction to the extent of 14,800 linear feet, at the additional total cost of \$497,481.78. From 1906 to 1912 maintenance expenditure was required to the amount of \$183,998.79. The work described was fully effective until the high water of 1912, when the main river broke through between Hen and Chicken Islands, impinging directly upon the downstream end of the Hopefield work, with the result that the latter was flanked and about 700 feet lost; this loss was replaced in 1912 and extensive repairs otherwise made at a cost of \$61,616.60.

Again in the flood of 1913 the lower end of the work was similarly flanked, with the development of a large pocket cave incident to a powerful eddy—per-

haps the most extensive known in this vicinity—the location and effect of which was such as to require that the bank within the pocket and throughout the radius of activity of the eddy referred to be further protected. This was accomplished in 1913 by the installation of 2,307 feet of channel mattress, a number of connecting mattresses, upper bank paving, etc., at a total cost of \$125,179.86. Throughout the high waters since the flood of 1913 the entire Hopefield revetment has remained undisturbed and is therefore fully effective. Although the eddy described obtains in every river approaching a bank full stage, no further tendency to flank the downstream end of the work is apparent.

The total expenditure at Hopefield Bend prior to the fiscal year, therefore, amounts to \$1,704,277.03.

Operations and results during the fiscal year.—To prevent further enlargement of a large hole back of the revetment at Hopefield Point, which was made during the 1913 high water, an earthen dike 500 feet long was constructed between the hole and river bank. The slopes and crown of this dike were paved with concrete 6 inches thick and a cut-off wall of concrete 5 feet deep and 1 foot thick was placed on the upstream side. The dike served its purpose admirably although both ends were slightly damaged and should be repaired before another high water.

The foregoing work was accomplished by written formal agreement with Roach & Stansell at a total cost of \$7,296.03. The United States furnished the cement, sand, and gravel.

Condition at the end of fiscal year.—The revetment generally throughout this bend is in excellent condition. There is, however, a small pocket cave about 1,500 feet above Hopefield Point which should be repaired during next season. Some pocket caves occurred during the last high water below the lower end of the revetment, which, however, resulted in no damage to the work and are not of sufficient importance to warrant immediate attention.

Local cooperation.—None.

Effect of improvement.—The bank and channel throughout Hopefield bend were fixed from the installation of the Hopefield work until 1912 when, as observed above, the river changed its course, breaking through between Hen and Chicken Islands. Any tendency or possibility of cut-off of the river by way of Hopefield Lake has been obviated and the harbor of the city of Memphis maintained.

Proposed operations.—Repairs to the earth dike and to the small pocket cave 1,500 feet above Hopefield Point are contemplated.

(k) Memphis Harbor, Tenn.

Location.—Two hundred and thirty to two hundred and thirty-two miles below Cairo, left bank.

Original condition.—The city of Memphis differs from most of the Mississippi River towns to the extent that it is not located on delta ground, but upon what have been known as the Chickasaw Bluffs. These bluffs being reasonably stable, the river-front property of the town was constructed fairly close to the river bank. In the course of time, however, and during the early seventies bank erosion set up and progressed to the point of endangering the town and its valuable river-front improvements, so that it became necessary to consider the installation of protective works such that the city would be guarded against property loss, its harbor maintained, and its river commerce assured.

Previous projects.—None.

Existing project.—The existing project, adopted in 1878, contemplated the protection of the Memphis harbor front from further bank loss by the installation of spur dikes and woven-willow revetment.

Operations and results prior to the fiscal year.—Between the years 1878 and 1898 8 spur dikes and 14,800 linear feet of woven-willow revetment were installed from somewhat beyond the old mouth of Wolf River, south to near the present Frisco Bridge.

The cost of the work described was borne in part by the United States and in part by local interests. Out of a total expenditure of \$551,472.76 the United States provided \$508,000 and local interests \$43,472.76.

The work has been successful, having fully effected its purpose. Since 1898 no maintenance or other expenditure has been required.

Operations and results during the fiscal year.—Operations during the present year consist in the completion of the excavation of the diversion canal to divert the flow of Wolf River along the Memphis front, the dredging of a

channel between the Tennessee shore and the sand bar in front of the said harbor, and the construction of a dam across Wolf River to force the flow of that stream through the diversion canal, thence along the paved wharf with a view of maintaining a channel of sufficient depth during low-water season to serve water-borne traffic, and dredging a channel through a sand bar in the Mississippi River at the entrance of the Loosahatchee River to maintain a flow of water from the Mississippi River through the latter stream.

The foregoing work was under the direction of the secretary, Mississippi River Commission, until November 30, 1916, and thereafter under the direction of the district engineer officer, first and second Mississippi River districts. At the time the work was taken over by this office there were two dredges at work, a pipe-line hydraulic dredge and a dipper dredge, and some shore-protection work at the dam across Wolf River was in progress. The latter work was completed on December 15, 1916, and dredging operations were suspended due to a rise in the river on December 12, 1916. Upon the recession of high water dredging operations in Memphis Harbor were resumed with one pipe-line hydraulic dredge on May 2, 1917, and on May 22 another pipe-line hydraulic dredge commenced operations cutting a channel through a sand bar in the Mississippi River at the entrance of the Loosahatchee River with a view of maintaining a flow of water from the Mississippi River through the latter stream, and to afford facilities for serving various manufacturing interests located on Wolf River. On May 24 hydraulic grader No. 1205 was put to work washing the deposit of mud and silt off the paved wharf.

These operations were still in progress on May 31, 1917.

The foregoing work was accomplished with hired labor, using Government plant, at a total cost since December 1, 1916, of \$20,547.97. The sum expended under the direction of the secretary, Mississippi River Commission up to November 30, 1916, amounted to \$90,331.90, making a total cost up to May 31, 1917, of \$110,897.87.

Condition at the end of fiscal year.—The condition of all bank-protection work in the Memphis Harbor is excellent. The depth and width of the channel along the paved wharf is ample to take care of all river-borne traffic, but dredges will have to be used to maintain it.

Local cooperation.—The town of Memphis contributed to the bank protection work above described, \$43,472.76.

Effect of improvement.—The town of Memphis has been relieved of the danger of property loss, and its harbor maintained. The restrictions of the city's wharfage and river conveniences which existed at the end of the last fiscal year have been corrected by the Wolf River diversion canal and dredging along the paved wharf. In order to maintain the Memphis Harbor dredging will probably have to be resorted to every low-water season.

Proposed operations.—It is proposed to continue dredging operations during the coming low-water season in the channel along the Memphis front and through the bar at the entrance of the Loosahatchee River and to increase the height of the Wolf River Dam.

(1) *Star Landing, Miss.*

Location.—Two hundred and fifty-seven miles below Cairo, left bank.

Original condition.—Caving in Star Landing Bend had been persistently active for a number of years, to the extent that the adjacent levees were several times breached, necessitating the construction of some four levee loops. In 1912 and 1913 the rate of caving was such as to again seriously threaten the levee system, to guard against which revetment protection was authorized at the combined cost of the Federal Government and the local levee district.

Previous projects.—None.

Existing project.—Adopted in 1914; contemplates the construction of about 10,000 linear feet of standard fascine revetment, located in the most advantageous relation to the levee system.

Operations and results prior to the fiscal year.—The work accomplished prior to the present year consisted in the protection by standard willow fascine revetment of 10,635 linear feet of bank, at a cost of \$365,161.29 for new work and \$785.65 for repairs.

Operations and results during the fiscal year.—Operations during the present year consisted in repairs by the installation of 1,148 squares of connecting mattresses in several pocket caves in the existing work, 1,820 squares of grading, and 1,022 squares of paving along the upper bank in the caves referred to. Work was commenced on November 9, 1916, but had to be suspended on account

of high water on January 10, 1917. Operations were resumed on February 8, but had to be suspended again on account of high water on February 27, 1917.

During the rise of the river in January and February, 1917, quite extensive breaks in the revetment occurred which destroyed about 3,000 feet of revetment. The destroyed work should be replaced during the coming season.

The repair work referred to above was accomplished by hired labor with Government plant, at a cost of \$37,670.61.

The following table gives detailed cost:

STAR LANDING, MISS. (257 L.), FIRST AND SECOND DISTRICTS.

Mattresses, total area, 1,148 squares (connecting mats, 100 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$385.00		\$0.335
$\frac{1}{2}$ -inch strand.....pounds..	3,000	208.50	2.613	.182
$\frac{3}{4}$ -inch strand.....do.....	4,500	246.25	3.920	.214
$\frac{1}{2}$ -inch strand.....do.....	6,500	415.50	5.662	.362
Wire No. 9.....do.....	4,400	166.00	3.833	.145
Staples.....do.....	300	9.50	.261	.008
Clips, $\frac{1}{2}$ -inch.....number..	200	23.00	.174	.020
Clips, $\frac{3}{4}$ -inch.....do.....	600	38.40	.523	.033
Brush and poles.....cord..	1,650	2,887.10	1.437	2.515
Rope, manila.....pounds..	1,000	184.00	.871	.160
Miscellaneous expenses.....		130.00		.113
Subsistence.....		1,738.41		1.514
Steamboat expenses.....		2,983.91		2.599
Labor.....		4,037.00		3.517
Supervision.....		589.50		.51
Total.....		14,042.07		12.231
Total field cost.....		14,042.07		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$185.00		\$0.161
Stone.....tons.....	865	1,418.60	.753	1.236
Rope, manila.....pounds..	400	73.60	.548	.064
Miscellaneous expenses.....		70.00		.061
Subsistence.....		886.40		.772
Steamboat expenses.....		1,491.95		1.300
Labor.....		2,018.45		1.758
Supervision.....		295.00		.257
Total.....		6,439.00		5.609
Total field cost.....		6,439.00		

Grading (1,820 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$95.00		\$0.052
Rope, manila.....pounds..	200	36.80	0.110	.020
Coal.....tons.....	97	279.80	.050	.154
Oil.....		18.00		.010
Miscellaneous expenses.....		175.00		.096
Subsistence.....		232.80		.128
Steamboat expenses.....		525.00		.288
Labor.....		534.85		.294
Supervision.....		75.00		.041
Total.....		1,972.25		1.083
Total field cost.....		1,972.25		

Paving (concrete, 646 squares; stone, 376 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$285.00		\$0.279
Stone..... tons.....	1,052	1,734.86	1.029	1.697
Rope, Manila..... lbs.....	400	73.60	.391	.072
cement..... sacks.....	2,360	861.40	2.309	.842
Gravel and sand..... cubic yards.....	732	366.00	.716	.358
Coal..... tons.....	23	76.41	.022	.075
Oil.....		5.00		.005
Miscellaneous expenses.....		73.48		.072
Subsistence.....		1,278.80		1.251
Steamboat expenses.....		2,225.40		2.178
Labor.....		3,510.20		3.435
Supervision.....		480.50		.470
Total.....		10,970.65		10.734
Total field cost.....		10,970.65		

Summary of costs (linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total. ¹
	Per square.	Total.	Per square.	Total.	
Total field cost.....	\$17.840	\$20,481.07	\$11.817	\$12,942.90	\$33,423.97
Surveys.....	.079	91.23	.053	57.60	148.83
Care of plant.....	.346	397.55	.230	251.00	648.55
Repair of plant.....	.833	955.77	.551	602.96	1,558.73
Depreciation of plant.....	1.009	1,158.90	.669	731.63	1,890.53
Total.....	20.107	23,084.52	13.320	14,586.09	37,670.61

¹ All repair work, hence the cost per linear foot of bank protected can not be given.

Condition at the end of fiscal year.—All revetment except about 3,000 feet destroyed is in excellent condition. With the renewal of the destroyed work, complete protection will be afforded to the levees throughout this reach. There has been no recurrence of the surface scour behind the upper bank work mentioned in the last annual report.

Local cooperation.—The Yazoo-Mississippi Delta Levee Board contributed to the cost of the work in place the sum of \$210,000.

Effect of improvement.—Notwithstanding the destruction of about 3,000 feet of revetment, the integrity of the levees has been maintained. Abnormal currents developed in the river during the past high water, which attacked and destroyed the work referred to above. The channel appears to be in a state of transition, due no doubt to changes in the bend above.

Proposed operations.—The replacement of the destroyed work.

(m) Porter Lake, Ark.

Location.—Two hundred and sixty-one miles below Cairo, right bank.

Original condition.—Prior to 1910 more or less intermittent caving had taken place in the vicinity of Porter Lake, though dangerous proximity to the Arkansas levee had not developed until about the year named. The importance of maintaining the existing levee line centers in the fact that a number of lakes are found in such relation thereto that a levee loop, which of necessity would have to be located behind the said lakes, would in consequence have been very extensive and costly. The alternative was, therefore, the construction of revetment, to the end of holding the channel to position and of maintaining the existing levee line.

Previous projects.—None.

Existing project.—Authorized in 1911; contemplated the construction of standard fascine revetment to prevent further bank caving.

Operations and results prior to the fiscal year.—The operations at Porter Lake prior to the present year consisted in the installation of 8,640 feet of standard revetment during the years 1911, 1912, and 1913. The work has been efficient, holding the bank and obviating the necessity for the construction of a costly levee loop; \$381,454.03 has been expended for construction and \$18,410.21 for maintenance, a total of \$399,864.24.

Operations and results during the fiscal year.—A revetment plant was placed at this point on March 10, 1917, but on account of the high stage of the river active mat construction was not commenced until May 15. Preliminary work, however, such as clearing the bank and digging deadman holes, commenced May 7. At the end of the season work was still in progress, 582 feet of channel mattress No. 1 having been constructed.

The foregoing work was done by hired labor with Government plant, at a total cost of \$25,932.87, which includes the cost of certain materials for the further prosecution of the work.

Inasmuch as no work was completed, no table of costs is given.

Condition at the end of fiscal year.—The upper 5,200 feet of the work is in effective condition. The lower 3,400 feet, however, has been destroyed, and work of replacing same is in progress. In addition to the loss of work referred to, caving has progressed downstream for a distance of about 5,000 feet below the original downstream end of the revetment. The bank along this reach had been perfectly stable for a number of years. During the past high water, however, active caving began in the vicinity of Fritz Landing and is still more or less active, and will necessitate the extension downstream of this revetment for a distance of about 5,000 feet below the original work.

Local cooperation.—None.

Effect of improvement.—The revetment described has fixed the channel and has maintained a stable bank throughout the upper part of the Porter Lake bend. The adjacent levee has been protected. For continued similar results the portion of the lower work destroyed must be replaced and work extended downstream to cover the recently actively caving bank.

Proposed operations.—It is proposed to replace some 3,400 feet of lost revetment at the downstream end of the bend and extend the work still farther downstream for a distance of about 5,000 feet.

(n) *Walnut Bend, Ark.

Location.—Two hundred and eighty-one miles below Cairo, right bank.

Original condition.—Bank caving throughout Walnut Bend finally brought the Mississippi River into such relation to the St. Francis River as to suggest the danger of cutoff between the two. Moreover, the river bank had approached the Arkansas Levee to the point that the latter was in imminent hazard of being breached, a condition that would have required the construction of an expensive levee loop. The combined situations therefore finally led, in 1907, to the necessity that Walnut Bend be protected by revetment.

Previous projects.—None.

Existing project.—The existing project, initiated in 1907, provided for the installation of about 7,000 feet of standard fascine revetment, placed with relation to the adjacent levee, and with due regard to the possibility of cutoff between the Mississippi and St. Francis Rivers.

Operations and results prior to the fiscal year.—During the years 1907, 1908, 1909, 1910, and 1911 7,160 feet of revetment was placed at a total cost of \$413,870.16, of which \$374,149.96 applies to new construction and \$39,720.20 to repairs.

As a result of the work described the revetted bank has since remained stable.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The entire length of revetment is in excellent condition. A resumption of active caving at the lower end of the bend is observed, though the existing revetment is not affected thereby. For several years past a deepening is noted at the outer edge of the downstream end of the work, though its extent is not sufficient to suggest any serious instability of the construction.

Local cooperation.—None.

Effect of improvement.—Walnut Bend has been made stable throughout the length of its revetment; the adjacent levee has been safeguarded from destruction, and whatever danger of cutoff between the Mississippi and St. Francis Rivers may have existed has been eliminated.

Proposed operations.—None.

(o) *Trotters, Miss.*

Location.—Three hundred and four miles below Cairo, left bank.

Original condition.—For many years bank caving throughout Trotters bend has been persistent, with the result that the river in 1912 had attained hazardous proximity to the Mississippi Levee near the lower end of the bend. The estimated cost of a levee loop was such that the alternative of bank revetment was concluded upon.

Previous projects.—None.

Existing project.—Adopted in 1912; provides for controlling this bend and protecting the adjacent levee by the installation of continuous bank revetment.

Operations and results prior to the fiscal year.—The construction in question was accomplished during the years 1912 and 1913 to the extent of 6,625 feet, at total cost of \$271,953.70 for new work and \$2,949.56 for repairs. The work has resulted in fixing channel and bank conditions throughout the length of the work.

Operations and results during the fiscal year.—None.

Condition at the end of fiscal year.—The entire revetment is in excellent condition. Some minor repairs to upper-bank paving remain to be done. Such will be undertaken when suitably low-river stages obtain.

Caving continues throughout the upper part of the bend, and will probably require during the next couple of seasons upstream extension of the work in place.

Local cooperation.—The Yazoo-Mississippi Delta Levee Board contributed 100,000 to the cost of the Trotters revetment.

Effect of improvement.—The lower end of the bend has been made stable, the confronting channel fixed, and the adjacent Mississippi River levee maintained, thus eliminating the alternative necessity for the construction of a costly levee loop.

Proposed operations.—None at present. It is probable that upstream extension of the existing work may be required within the next few years.

(p) *Helena, Ark.*

Location.—Three hundred and six miles below Cairo, right bank.

Original condition.—The river bank in the vicinity of Helena during the eighties showed intermittent sloughs or settlements in the nature rather of artificial sinks than of the ordinary bank caving. The difference was recognized, as is evident from the statement regarding the low ground immediately behind the Helena Levee, which in 1888 was referred to as "a swamp * * *, which seems to have been the most prolific cause of caving for some years past." To minimize the supposed effects of this swamp it was proposed that this low ground should be drained by way of a canal to the south. By 1888 the settlements or sinks referred to had caused bank recession to the point of jeopardizing the property and industries of the town. These sinks or subsidences, of greater or less extent, continued to occur at irregular intervals till in 1913 the most extensive of all appeared.

Previous projects.—None.

Existing project.—The existing project was adopted in 1888 and contemplates the construction of fascine revetment and spur dikes along the Helena front to the extent necessary to make stable bank conditions in that locality.

In addition, by a special item in the river and harbor act of March 4, 1913, 100,000 was provided "to prevent a breach in the Helena front levee by revetment or otherwise."

Operations and results prior to the fiscal year.—Between the years 1889 and 1898, inclusive, 7 revetment dikes and 5,000 linear feet of standard fascine revetment were installed along the Helena front, at a total cost of \$199,000. Repairs and maintenance since 1898 have cost \$40,018.81, making an aggregate of \$239,018.81.

In addition to the revetment costs, 47 borings, aggregating 3,597 feet in length, were taken in 1913, 1914, and 1916, at a cost of \$8,084.77, to the end of determining the underlying causes of instability along the Helena foreshore.

In 1914, 99,605 cubic yards of stable hill earth were deposited over the area of subsidence at a cost of \$44,949.19.

The borings above referred to clearly established the existence of a number of layers of very unstable and, in some cases, quick material underlying the Helena vicinity, at a depth below the natural surface of some 40 to 60 feet. In cases these layers of unstable material had total thicknesses of 50 feet and rested throughout on an underlying strata of hard, impervious, brown clay, found at maximum depths of about 95 feet. The uppermost layers of the unstable material in consideration are found at about the zero of the Helena gage.

Operations and results during the fiscal year.—At the direction of the Mississippi River Commission investigation of the Helena situation by borings was continued. During the low-water period of 1916 five additional borings were secured in the river. The said borings disclosed results similar to those previously made.

The foregoing work was accomplished by hired labor with Government plant at a total cost of \$1,150.33.

All revetment work is in excellent condition.

Condition at the end of fiscal year.—During the past low-water season the foreshore has shown no evidence of instability. It is practically certain, however, that in a long period of low water further subsidences will occur to the northward of the area already affected.

Local cooperation.—None.

Effect of improvement.—The revetment work along the Helena front has protected the town and its industries to the south from encroachment by the river. It has not, however, provided against subsidence of the foreshore, the instability of which has reappeared at irregular intervals.

The deposit of stable hill earth over the disturbed area is shown by borings to have forced out practically all underlying unstable material for a short distance, which suggests that continued though indefinite fill, following further evidence of instability, may be expected to restore conditions of essential equilibrium.

Proposed operations.—None.

(g) Delta, Miss.

Location.—Three hundred and fifteen miles below Cairo, left bank.

Original condition.—Caving at this point, which had been active for a number of years, developed in 1914 a condition of such menace to the controlling levee, located between the river bank and the foot of Moon Lake, as to require the revetment of the Delta Bend. The destruction of the levee would have necessitated the construction of a long and expensive loop around the said lake. To guard against such a contingency revetment protection was authorized at the combined cost of the Federal Government and local levee district.

Previous projects.—None.

Existing project.—The existing project, adopted in 1915, contemplated the installation of about 9,000 feet of standard fascine revetment located in required relation to the levee system.

Operations and results prior to the fiscal year.—Operations prior to the fiscal year consisted in the installation of 5,030 feet of fascine mattresses and 2,950 squares of upper-bank paving, at a cost of \$209,702.53. The project was not completed on account of very unfavorable river stages which prevailed almost throughout the entire working season.

Operations and results during the fiscal year.—Operations on the project were continued until June 12, 1916, when they had to be suspended on account of the high stage of the river. Operations were resumed again on July 11 and prosecuted continuously until completion of the work on December 11, 1916. During the season 2,165 linear feet of channel mattresses, 1,462 squares of connecting mattresses, and 3,490 squares of paving were installed. Part of the connecting mattresses and paving placed was along the last season's work to complete the same.

The foregoing work was accomplished by hired labor with Government plant at a total cost of \$122,775.59.

The following table gives detailed cost:

DELTA, MISS. (315 L.), FIRST AND SECOND DISTRICTS.

Mattresses, total area, 6,908 squares (channel mats, 79 per cent; connecting, mats, 21 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
obilization and demobilization.....		\$145.20		\$0.021
inch strand..... pounds..	45,500	3,162.20	6.574	.458
inch strand..... do.	11,500	629.25	1.665	.091
inch strand..... do.	47,200	3,020.00	6.833	.437
ire, No. 9..... do.	21,300	803.25	3.083	.116
ire Silicon Br..... do.	1,600	328.00	.232	.047
aples..... do.	1,200	38.00	.174	.005
ips, $\frac{1}{8}$ -inch..... number..	3,000	337.00	.434	.041
ips, $\frac{1}{8}$ -inch..... do.	3,000	191.30	.434	.030
ush and poles..... cords..	9,485	14,227.05	1.373	2.060
ope, manila..... pounds..	6,279	1,140.22	.909	.165
iscellaneous expenses.....		1,107.31		.160
bsistence.....		12,071.85		1.747
eamboat expenses.....		5,307.48		.768
bor.....		17,462.20		2.528
perservation.....		2,688.25		.389
Total.....		62,658.56		9.071
Total field cost.....		62,658.56		

BALLASTING AND SINKING.

obilization and demobilization.....		\$72.60		\$0.011
one..... tons..	4,378	7,220.46	0.634	1.045
pe, manila..... pounds..	2,512	456.09	.364	.066
scellaneous expenses.....		276.80		.040
bsistence.....		1,810.00		.262
eamboat expenses.....		710.40		.103
bor.....		2,532.40		.366
perservation.....		336.75		.049
Total.....		13,415.50		1.942
Total field cost.....		13,415.50		

Grading (2,640 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
obilization and demobilization.....		\$36.30		\$0.014
pe, manila..... pounds..	1,256	228.04	0.476	0.086
il..... tons..	385	1,047.36	.146	.397
		61.41		.023
scellaneous expenses.....		436.87		.165
sistence.....		1,009.71		.382
eamboat expenses.....		250.00		.095
bor.....		2,398.83		.909
perservation.....		225.00		.085
Total.....		5,693.52		2.156
Total field cost.....		5,693.52		

Paving (concrete, 2,780 squares; stone, 710 squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$108.90		\$0.031
Stone..... tons.....	2,037	3,340.68	0.583	.957
Rope, manila..... pounds.....	2,511	456.09	.719	.131
Cement..... sacks.....	11,364	4,560.48	3.256	1.307
Sand and gravel..... cubic yards.....	3,135	2,351.49	.893	.674
Coal..... tons.....	40	119.20	.012	.034
Oil.....		17.40		.005
Miscellaneous expenses.....		250.00		.072
Subsistence.....		2,625.40		.752
Steamboat expenses.....		4,125.00		1.181
Labor.....		4,596.32		1.317
Supervision.....		1,750.00		.502
Total.....		24,300.96		6.963
Total field cost.....		24,300.96		

Summary of costs (2,165 linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total.	Total cost per linear foot. ¹
	Per square.	Total.	Per square.	Total.		
Total field cost.....	11.013	\$76,074.06	9.119	\$29,994.48	\$106,068.54	39.86
Office expenses.....	.005	36.35	.004	14.33	50.68	.02
Surveys.....	.028	190.04	.023	75.06	265.10	.10
Care of plant.....	.269	1,860.69	.223	733.52	2,594.21	1.00
Repair of plant.....	.647	4,471.98	.536	1,762.95	6,234.93	2.34
Depreciation of plant.....	.785	5,423.95	.651	2,138.18	7,562.13	2.84
Total.....	12.747	88,057.07	10.556	34,718.52	122,775.59	46.16

¹ Includes the cost of completing connecting mattresses and paving along last season's work.

Cost of completing last season's work.

Total field cost.....	\$19,768.30
Office expenses.....	9.45
Surveys.....	49.44
Care of plant.....	438.82
Repair of plant.....	1,162.81
Depreciation of plant.....	1,410.34
Total.....	22,839.16

Condition at the end of fiscal year.—Caving has entirely ceased throughout the portion of the bend revetted and the integrity of the controlling levee line is assured. The extension of the work downstream may be required at some future date.

Local cooperation.—The Yazoo-Mississippi Levee Board contributed \$160,000 to the cost of the work.

Effect of improvement.—The channel in Delta Bend has been fixed throughout the stretch revetted, further bank caving prevented, and the necessity for the construction of a costly levee loop around Moon Lake obviated.

Proposed operations.—Minor repairs to the upper bank pavement will be made during the coming season

(r) Oldtown, Ark.

Location.—Three hundred and twenty-four miles below Cairo, right bank.

Original condition.—Continued caving over a number of years prior to 1907 finally required, in that year, revetment of Oldtown Bend or the construction of a levee loop, the river bank having receded almost to the toe of the existing levee.

Previous projects.—None.

Existing project.—The existing project was adopted in 1907 and contemplated the installation of sufficient revetment to fix the channel and bank line throughout the bend and thus to protect the adjacent Arkansas levee.

Operations and results prior to the fiscal year.—Beginning in 1907, to and including 1913, about 8,455 feet of standard fascine revetment and about 500 feet of sawed lumber revetment were installed at a cost of \$456,342.84.

The result was the stabilization of the Arkansas bank of the river for the length named and for some distance below.

Operations and results during the fiscal year.—Operations were commenced on December 12, 1916, but suspended on account of high water on January 12, 1917. Operations were resumed on January 19, but interrupted on March 5, resumed again on May 2, and are still in progress at the end of the season. During the season 6,945 squares of subaqueous work was placed.

The foregoing work was accomplished by hired labor with Government plant, at a total cost of \$87,570.64.

The following table gives detailed cost:

OLD TOWN BEND (324 R.), FIRST AND SECOND DISTRICTS.

Mattresses, total area, 6,945 squares (channel mats, 60 per cent; connecting mats, 40 per cent).

BUILDING MATS.

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$206.70		\$0.030
1-inch strand.....pounds..	35,324	2,455.00	5.086	.353
1-inch strand.....do..	16,000	875.50	2.304	.126
1-inch strand.....do..	40,000	2,559.00	5.760	.368
Wire No. 9.....do..	23,185	874.25	3.338	.126
Wire silicon Br.....do..	1,200	246.00	.173	.035
Caples.....do..	1,000	31.75	.144	.005
Rings, 1/2 inch.....number..	2,100	236.20	.302	.034
Rings, 1/2 inch.....do..	2,000	127.50	.288	.018
Rush and poles.....cords..	9,645	17,330.18	1.390	2.495
Rope, manila.....pounds..	5,023	911.98	.723	.131
Miscellaneous expenses.....		607.92		.088
Subsistence.....		8,477.54		1.221
Steamboat expenses.....		8,215.29		1.183
Labor.....		13,328.28		1.919
Supervision.....		2,145.00		.309
Total.....		58,628.09		8.441
Total field cost.....		58,628.09		

BALLASTING AND SINKING.

Mobilization and demobilization.....		\$103.30		\$0.015
1-ton.....tons..	4,292	7,060.34	0.618	1.016
Rope, manila.....pounds..	2,512	455.99	.362	.066
Miscellaneous expenses.....		144.00		.021
Subsistence.....		2,166.38		.312
Steamboat expenses.....		1,643.10		.236
Labor.....		2,665.60		.384
Supervision.....		430.00		.662
Total.....		14,668.71		2.112
Total field cost.....		14,668.71		

Grading (35½ squares).

Items.	Quantity used.		Per square.	
	Total quantity.	Total cost.	Quantity.	Cost.
Mobilization and demobilization.....		\$53.00		\$0.150
Rope, manila.....pounds.....	837	151.99	2.364	.429
Coal.....tons.....	53	158.40	.150	.447
Oil.....		19.37		.055
Miscellaneous expenses.....		151.22		.427
Subsistence.....		188.00		.531
Steamboat expenses.....		110.00		.311
Labor.....		420.00		1.186
Supervision.....		125.00		.353
Total.....		1,376.98		3.889
Total field cost.....		1,376.98		

Summary of costs (linear feet revetted).

	Subaqueous work.		Upper bank work.		Grand total. ¹
	Per square.	Total.	Per square.	Total.	
Total field cost.....	\$10.553	\$73,296.80	\$3.889	\$1,376.98	\$74,673.78
Office expenses.....	.211	1,463.72	.078	27.47	1,491.19
Surveys.....	.019	134.14	.007	2.53	136.67
Care of plant.....	.253	1,750.51	.093	33.01	1,783.52
Repair of plant.....	.605	4,207.16	.224	79.35	4,286.51
Depreciation of plant.....	.734	5,102.73	.272	96.24	5,198.97
Total.....	12.375	85,955.06	4.563	1,615.58	87,570.64

¹ Not completed on account of interruption by high water.

Condition at the end of fiscal year.—The upper 6,000 feet of revetment is in effective condition. However, the lower 3,000 feet has been practically destroyed by the last two high waters, the renewal of which was in progress at the end of the season's work.

Local cooperation.—None.

Effect of improvement.—The Arkansas Levee, adjacent to the upper end of Oldtown Bend, has been protected, and the necessity for a costly substitute has been avoided.

Proposed operations.—The renewal of the portion of the work destroyed, which is now in progress and will be continued.

(s) Sunflower, Miss.

Location.—Three hundred and fifty-five miles below Cairo, left bank.

Original condition.—Caving in Sunflower Bend, active for a number of years, finally brought the bank of the river practically to the toe of the Mississippi Levee, thus requiring that the latter be reconstructed, or that revetment be placed for its protection.

Previous projects.—None.

Existing project.—Initiated in 1911; provided for sufficient revetment to fix channel and bank conditions throughout the bend, thus making possible the retention of the adjacent levee.

Operations and results prior to the fiscal year.—During the years 1911, 1912, and 1913, 9,670 feet of standard fascine revetment were installed, at a total cost of \$429,383.58.

Operations and results during the fiscal year.—None

Condition at the end of fiscal year.—During the past two high waters four pocket caves developed in the upper bank work which destroyed about 1,200 near feet of bank paving. These pockets are quite deep, and to repair them will require large connecting mattresses in order to make good connection between the new shore line and the old subaqueous work in addition to bank paving and grading.

Local cooperation.—The Yazoo-Mississippi Delta Levee Board contributed to the cost of the work the sum of \$92,500.

Effect of improvement.—The river channel and bank throughout Sunflower and has been made generally stable, the adjacent levee guarded against destruction, and the construction of an extensive and costly levee loop has been avoided.

Proposed operations.—Repairs to the pocket caves mentioned above and the possible extension of the work downstream.

Mississippi River Commission, first and second districts—Data of cost of revetment June 1, 1916, to May 31, 1917.

Location.	Expended as per financial statement.	Debits to material on hand.	Credit by material on hand.	Total field cost.	Unit field cost.		Unit overhead cost.		Work accomplished.		Total cost of work.	Gross unit cost. ¹		Remarks.
					Per square.	Per linear foot.	Per square.	Per linear foot.	Squares. (2)	Linear feet.		Per square.	Per linear foot.	
Slough Landing Neck.	{ ³ \$535.30 44,974.46}	.....	\$5,426.85	{ ⁴ \$9,650.20 30,018.20}	\$10.84	\$39.29	\$1.51	\$5.48	3,659	764	{ ⁴ \$10,997.37 34,207.81}	\$12.35	\$44.77	Grading and paving not completed on account of high water.
Gayoso Bend, Mo.....	{ ³ \$150,000.00 45,371.66}	.....	10,482.02	181,623.04	10.68	.....	1.70	.....	17,005	5,578	210,500.99	12.38	.....
Barfield, Ark.....	{ ³ 1,545.98 132,422.35}	\$1,918.12	.....	133,301.07	11.01	38.36	1.82	6.34	12,112	3,475	155,351.09	12.83	44.70	{Repairs to existing works.
Bullerton Bar, Ark...	{ ³ 20,041.39 124,913.57}	.....	741.72	{ ⁴ 34,485.10 108,051.75}	9.85	36.50	1.49	5.58	14,466	2,960	{ ⁴ 39,553.47 124,550.85}	11.34	42.08	
Star Landing, Miss...	{ ³ 11,189.42 19,894.15}	2,489.23	.....	32,423.97	14.94	.....	2.42	.....	2,170	.....	37,670.61	17.36	.....	Not completed on account of high water.
Delta, Miss.....	92,446.83	13,937.49	.....	{⁴ 19,768.30 86,300.24}	10.20	39.86	1.61	6.30	10,398	2,165	{ ⁴ 22,839.16 99,936.43}	11.81	46.16	
Old Town Bend.....	55,720.24	17,581.40	.....	74,673.78	10.23	.....	1.77	.....	7,299	.....	87,570.64	12.00	.....

¹ Includes every item of field and overhead charges.² Squares include both subaqueous and upper bank work.³ Amount expended for account of this work from allotment for "General repairs and stone".⁴ The cost of completing upper bank work on last season's work.⁵ Amount expended from contributed funds from Lower St. Francis Levee Board of Missouri.

II. EXPERIMENTAL REVETMENT.

From funds made available by the river and harbor bill approved July 27, 1916, the Mississippi River Commission allotted the sum of \$150,000 for the construction of one complete unit with which to place subaqueous concrete revetment with a view of substituting this type of shore protection for the standard willow fascine type.

Work of procuring the necessary plant is in progress; plans and specifications for the steel machinery barge and concrete mixing plant have been approved by the Chief of Engineers and bids invited on same. An order for the machinery, cranes, etc., for the operation of the plant has been placed with the Bucyrus Co. of South Milwaukee, Wis., and lumber for the construction of two slab barges purchased.

The scarcity and high price of steel shapes will doubtless delay the construction of the steel machinery barge beyond the possibility of accomplishing any concrete revetment work during the coming season.

III. WOLF RIVER.

Location.—Two hundred and thirty miles below Cairo, left bank.

The work of improving the Memphis Harbor by diverting the flow of Wolf River along the Memphis front has eliminated the necessity of further dredging this stream; the project for its improvement may be regarded as completed.

For description and previous history, see Annual Report, Chief of Engineers, 1916, Part III, page 3408.

IV. LEVEES.

General.—All levees are being constructed to the grade and section fixed by the Mississippi River Commission by resolution adopted April, 1914, which provides that the grade shall be 3 feet above the deduced confined flood of 1912, with section having a crown 8 feet wide, river slope 3 to 1, land slope 3 to 1 to 5 to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee, with back slope of 4 to 1.

(a) Upper St. Francis district.

Location.—On the right bank of the river from Cape Girardeau, Mo., 54 miles above Cairo, to New Madrid, Mo., 70 miles below. This district comprises an area of about 700 square miles.

Original condition.—The United States made its first levee expenditure in this district in 1899. At that time there existed fragments of levees constructed by local boards and individual land owners, but nothing to be dignified as a levee system. The most important of these several detached lengths of levee were found between Commerce and the Iron Mountain Railroad, and from Bird's Point for about 3 miles south. They merely joined the relatively higher levees found variously along the upper St. Francis front and were capable of straining only the mildest overflows.

Previous projects.—None.

Existing project.—The present project is to complete the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1899. It has been modified from time to time, and at present contemplates the enlargement of the existing line, in cooperation with the State and local levee boards, to a grade 3 feet above the deduced confined flood of 1912, with section having a crown of 8 feet width, river slope 3 to 1, land slope 3 to 1 to 8 feet below crown, and thence a banquette of varying crown widths from 20 to 40 feet, dependent upon the height of the levee, with back slope of 4 to 1.

This levee line, when complete, will have a total length of about 87 miles.

Operations and results prior to the fiscal year.—During the year 1899 the Government's efforts were directed to the reconstruction and extension of the 20 miles of levee that existed from Bird's Point south. Upon the advent of the flood of 1903 but 5½ miles had been completed, which withstood the flood referred to without damage.

By the flood of 1907 the levee had been extended south to about Medley, approximately 26 levee miles below Birds Point. No levee damage was sustained from this high water, though the lower end of the basin was generally overflowed, due to the fact of unleveed low ground for about 2 miles between the lower end of the levee above referred to, and a length of levee, then under construction by the local board as far south as Dorena.

By 1912 the system had been extended north to Campbell's schoolhouse, with the exception of a small gap at Big Lake Crossing, and south to about Dorena, Mo., thus giving a continuous length of about 55 miles, with the exception noted. The elevations and sections of much of the line were seriously deficient for the restraint of such a flood as that of 1912, so that practically the entire system from Big Lake south was submerged. About 12 crevasses of size occurred, together with numerous small breaks and much top wash.

Again, upon the advent of the 1913 flood the system had been insufficiently developed, so that again very general damage resulted, including five serious crevasses, together with a number of minor breaks and extensive top wash.

Since 1913 to the beginning of the fiscal year all crevasses have been closed and the system strengthened materially, to the extent that very certain protection to the back country may be anticipated as to any but extreme floods. An open gap, of course, still remains from the lower end of the line to New Madrid, a distance of about 19 miles.

At the beginning of the fiscal year the United States had provided in the Upper St. Francis 4,211,239 cubic yards, at a total cost of \$1,017,167.05, including maintenance and high-water charges.

Operations and results during the fiscal year.—During the year the United States has added to the Upper St. Francis levees 84,961 cubic yards, and the local levee boards 423,139 cubic yards. The Government's expenditure for the year has been about \$47,208.69, and that of the local levee boards about \$117,143.71.

During the year the Mississippi County Levee Board No. 1 completed work on its contract for extension of the system, from mile 65/4 to 67/45. This contract involved 532,990 cubic yards, at a price of 15 cents per yard.

The St. Johns Levee and Drainage District has practically completed its contract for the construction of about 11 miles of levee, beginning just below New Madrid and running in a northeasterly direction to high ground.

This contract comprised 853,307 cubic yards, 788,897 of which has been placed.

The purpose of this operation is to prevent inflow into the Lower St. Francis basin around the head of its levee system. It is therefore virtually a part of the latter system, although not at this time connected. The yardage and cost involved are accordingly carried in Lower St. Francis tables.

Contract was executed by this office September 10, 1915, with the Oglesby Construction Co. for levee extension south toward New Madrid from the end of Mississippi Levee Board's contract above referred to, with time limit for completion December 31, 1917. The cost of the work has been provided for by available Government funds combined with a contribution by the St. Johns Levee and Drainage District of \$200,000. The contract will be executed by a tower drag line excavator, the erection of which, at the site of the work, was completed in May, 1916. This excavator is a development of the type of machine engaged for the past two seasons upon enlargement work near Scanlons, Ark. It will operate a bucket of 10-yard capacity to be dragged upon the ground from digging to dumping position, and is equipped with power estimated to be sufficient to insure a cycle of operation in from two to two and one-half minutes. It is not unreasonable to anticipate that this machine will execute the levee work to which assigned at the minimum rate of 200 cubic yards per working hour.

Contracts in force at the beginning of the year and those since executed are given in the following table, which includes a statement of the date, or percentage, of completion of each:

Location.	Class.	Miles from Cairo.	Cubic yards.	Price.	Contractor.	Date of completion and per cent completed May 31, 1917.
1-16/28.....	Enlargement.....	<i>Above.</i> 30 R....	164,384	<i>Cents.</i> 11.85	Robt. Nicholson & Co.	July 31, 1916.
1-13/20.....	do.....	33 R....	18,069	26.95	R. L. Leonard....	Dec. 2, 1916.
2-6-22/0.....	do.....	26 R....	124,000	21.00	do.....	28 per cent.
2-24/0.....	do.....	24½ R....	200,000	26.95	do.....	30 per cent.
2-20/15.....	do.....	23 R....	176,000	21.00	do.....	12 per cent.
5-68/21.....	New work.....	<i>Below.</i> 41 R....	170,000	20.00	Oglesby Construction Co.	19 per cent.
6-1-69/0.....	do.....	41 R....	115,000	18.00	do.....	Not begun.
6-69/27.....	do.....	42 R....	140,000	16.00	do.....	Do.
6-7-70/0.....	do.....	42 R....	100,000	13.60	do.....	Do.
7-70/26.....	do.....	43 R....	102,000	12.00	do.....	Do.
7-6-71/0.....	do.....	43 R....	102,000	11.00	do.....	Do.
7-71/28.....	do.....	44 R....	100,000	10.00	do.....	Do.
7-8-72/0.....	do.....	44 R....	100,000	10.00	do.....	Do.
7-72/26.....	do.....	45 R....	158,000	16.56	do.....	Do.
7-6-76/0.....	do.....	45-48 R....	843,000	9.00	do.....	Do.

Progress on the Oglesby Construction Co.'s contract has been, unfortunately, delayed, incident to the frequent recurrence of moderately high river stages.

Condition at the end of fiscal year.—The upper St. Francis levee system, committed to the 1914 commission grade, will involve an estimated total of 14,294,439 cubic yards, of which 6,381,303 cubic yards were in place at the end of the year. The flood plane of the February, 1916, high water suggests the necessity that the grades of part of this system be raised, which will correspondingly increase the quantities just given.

Local cooperation.—The best available data would indicate that local authorities have provided to date in the construction of this levee system about 2,085,000 cubic yards, at a total cost of \$1,039,893.07. The amount stated comprehends not only actual construction, but all high-water expenses, charges for right of way, maintenance, administration, etc.

Proposed operations.—Continuation of levee extension and enlargement to the extent and at the rate that funds are made available. About 56 per cent of the project remains to be completed.

Effect of improvement.—Assured protection to about 660 square miles of territory against ordinary floods. As extension and enlargement proceed an increasing area will be similarly benefited with final and absolute protection of the entire district. 700 square miles, against estimated maximum floods, upon the consummation of the project.

Summary of yardage in place.

Provided by—	In place May 31, 1916.	Added during year.	In place May 31, 1917.	Under contract May 31, 1917.	Required to complete.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
United States.....	4,211,259	81,961	4,384,620	2,280,785	7,913,136
Levee boards.....	1,573,544	1,511,539	1,996,683	64,410	
Total.....	5,784,803	596,500	6,381,303	2,345,195	7,913,136

Credit given Mississippi County Levee Board No. 1 for \$34,000 contributed on the R. L. Leonard contract.

Plate No. 15 accompanies, showing present levee grades with relation to the published project grade.

(b) Reelfoot district.

Location.—This district is on the left bank of the river, extending from Hickman, Ky., 36 miles below Cairo, to upper Slough Landing Neck, Tenn., about 60

miles below Cairo. The levee system is continuous for a length of 21 miles and protects about 310 square miles of territory.

Original condition.—The United States initiated levee work in the Reelfoot district in 1902. At that time the basin was open with the exception that local authorities had constructed a levee from the Kentucky-Tennessee State line south to Slough Landing, a distance of about 4½ miles.

Previous projects.—None.

Existing project.—The original project provided for the construction of a levee from the Hickman bluffs south to the upstream end of the levee provided prior to 1902 by local authorities and the enlargement of the system to grade and section sufficient to protect the basin against overflow. This project was adopted in 1902. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

Operations and results prior to the fiscal year.—Beginning in 1902 construction was started at the Hickman Bluffs and continued as funds were available until, by 1908, junction was made with the existing levee at the Kentucky-Tennessee State line.

Upon the advent of the flood of 1912 the system was, therefore, continuous though deficient of grade and section to resist a flood of the magnitude involved: the result was a crevasse in the system by overtopping about 5 miles below Hickman, the entire basin being overflowed.

This crevasse was closed and the system materially strengthened upon the advent of the flood of 1913, which, under vigorous emergency measures, was successfully resisted, no damage to the levee line occurring except that incident to wave wash, etc., requiring but minor repair.

Prior to the present year the Government placed, in the Reelfoot system, a total of 1,781,395 cubic yards, at a total cost of \$418,482, including all maintenance and flood protection charges.

Operations and results during the fiscal year.—A contract was executed by the United States for the construction of a loop levee to blanket a part of the present levee which is threatened by caving on miles 3, 4, and 5. The details of this work are shown in the following table:

Location.	Class.	Miles below Cairo.	Cubic yards.	Price.	Contractor.	Completed, May 31, 1917.
2/37-4/36.....	New work and banquette.	39 L	336,000	Cents. 16.00	Roach, Stansell, Lowrance Bros. & Co.	69 per cent.

Condition at the end of fiscal year.—The Reelfoot system, when complete will involve a total of 4,028,000 cubic yards, of which 2,719,368 cubic yards were in place at the end of the year.

Local cooperation.—Local interests have thus far contributed a total of 861,204 cubic yards, at a cost of \$326,094.22, which includes all costs of actual construction, maintenance, high-water expenses, charges for right of way, general administration, etc.

Proposed operations.—A continuation of the enlargement of the system final grade and section to the extent and at the rate that funds are made available. About 33 per cent of the Reelfoot project remains to be completed.

Effect of improvement.—The construction thus far accomplished affords assured protection from ordinary floods to the entire basin. As the system progressively strengthened to completion, increased protection against overflow will be provided.

Summary of yardage in place.

Provided by—	In place May 31, 1916.	Added during year.	In place May 31, 1917.	Under con- tract May 31, 1917.	Required to com- plete.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
United States.....	1,781,395	76,769	1,858,164	102,981	1,308,632
Levee boards.....	704,954	156,250	861,204	.....
Total.....	2,486,349	233,019	2,719,368	102,981	1,308,632

¹ Credit given levee board for \$25,000 contributed on the Reel-foot Loop.

Plate No. 16 accompanies, showing present levee grades with relation to the established project grade.

(c) Lower St. Francis district.

Location.—On the right bank of the river from just below New Madrid, Mo., 3 miles below Cairo, to the mouth of the St. Francis River, 298 miles below Cairo. Within the limits defined, the Lower St. Francis Levee is continuous for a length of 211 miles. About 3,500 square miles of territory are protected.

Original condition.—When the United States assumed levee interest in the Lower St. Francis district there existed along its front detached fragments of levee, constructed by local boards and private landowners, to guard against flow through the swales and low places along the river bank. This condition did not assumed shape as a levee system, and was not expected to resist anything more than "out of bank water."

In referring to a map compiled in the second district in 1883, showing levee conditions throughout the St. Francis front, it is stated "the map shows that all the old levees were constructed to protect farming interests only"—presumably meaning purely local and detached farming interests.

Even as late as 1893 the conditions are described by the district officer to the effect that "water is practically free to escape from the banks into the low lands of the basins. The remnants of the old said levee, long since abandoned, which exist here and there along the whole length of the district, form no barrier to, and retard but little, the general escape of water from the banks."

"The overflows of the past few years have been very destructive, especially that of 1892, which, occurring very late in the season, made it impossible to make any crops whatever in many of the deeply submerged localities. The present overflow promises to be quite as disastrous as that of 1892."

Previous projects.—None.

Existing project.—The existing project was adopted in 1887 when 22 miles of levee were provided for, extending from Bear Bayou to Craighead Point, in connection with the improvement of Plum Point Reach. The project contemplates the construction and enlargement of the levees to a grade and section sufficient to protect the basin against overflow. It has been modified from time to time, and at present provides for the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

Operations and results prior to the fiscal year.—The first Government expenditure for levee purposes in this district was in connection with the Plum Point Reach improvement, and provided a levee from Bear Bayou to Craighead Point, to the end of suitably confining and directing flood waters throughout the reach.

No further levee construction of consequence was undertaken until between 1893 and 1897 when 115 miles were constructed to an elevation from 3 to 4 feet above the high water of 1882. This line extended from about Point Pleasant to Lean Point. In every flood of consequence, prior to 1897, the entire basin was subjected to overflow, but it appears that in the flood of the last-named year the system had advanced to the point that about 700 square miles were afforded protection, notwithstanding a number of crevasses, stated to have aggregated a total length of 13,405 feet.

Prior to the flood of 1903 the system had been continued south from Lean Point to Cat Island Bend, and a detached levee had been constructed from be-

hind Council Bend to the foot of Walnut Bend. In other words, in 1903 the system was continuous from Point Pleasant south for a distance of 173 miles followed by a gap of about 13 miles, where the second link of levee above referred to commence and extended downstream for a distance of about 17 miles. This last-named levee was started in the interest of preventing a cut-off between the Mississippi and St. Francis Rivers, and subsequently extended northward with the purpose of joining the system under extension to the south.

The system was deficient of sufficient height and section to resist the 1911 flood, with the result of two crevasses—one at Random Shot and one at Holly bush—aggregating a length of 2,935 feet. A large measure of protection was afforded the basin, however, as will be noted from the fact that the total area of overflow through the crevasses and through the levee gap below Cat Island as well as by way of backwater from the St. Francis River, amounted to but 1,230 square miles.

The system was continuous from Point Pleasant to below Walnut Bend, a distance of 218 miles, upon the advent of the flood of 1912, but was deficient of grade and section for the restraint of that unusual water. Three crevasses of magnitude and four of less moment resulted, and about 2,790 square miles of the basin was subjected to overflow. These breaks were promptly repaired, so that the line was again continuous to meet the 1913 flood, but was necessarily still deficient of grade and section for this water, whose flood plain, throughout the St. Francis front, was from 2 to 8 inches in excess of that in 1912. Again, four crevasses occurred and about 2,500 square miles of the basin were overflowed.

Following the flood of 1913 the crevasses of that year were immediately repaired, and to the beginning of the fiscal year a very large amount of enlargement work has been accomplished. Sufficient funds have been available by way of the Federal Government and the local levee boards to raise and strengthen practically all weak sections, so that a flood as great as that of 1912 or of 1911 might well be passed by the Lower St. Francis Basin, at least as far as Grave Bayou, 20 miles below Memphis.

To the beginning of the fiscal year the United States had provided 17,343,511 cubic yards in the Lower St. Francis levee system, at a total cost of \$4,027,605.00.

Operations and results during the fiscal year.—During the year the United States has enlarged the system to the extent of 869,119 cubic yards. The local levee boards have added 2,263,030 cubic yards. The Government's expenditure during the year has been \$197,673.51, and that of the local levee boards \$1,005,510.81.

Contracts in force at the beginning of the year, and those since executed, are given in the following table, which includes a statement of the date or percentage of completion of each:

Location.	Class.	Miles below Cairo.	Cubic yards.	Price.	Contractor.	Date of completion and per cent complete May 31, 1917.
				<i>Cents.</i>		
48/4-49/49.....	New work and banquettes.	130 R.	400,000	18.5	Rodgers Bros.....	61 per cent.
97/20-101/0.....	Enlargement.....	188 R.	200,000	26.0	R. L. Leonard.....	14 per cent.
101/0-103/0.....	do.....	190 R.	135,251	15.38	S. M. Bush.....	Sept. 13, 1910
103/0-105/35.....	do.....	190 R.	211,093	15.38	do.....	Sept. 8, 1910
140/0-140/29.....	do.....	217 R.	109,823	19.5	Roach, Stansell, Lowrance Bros. & Co.	Aug. 29, 1911
140/29-141/0.....	Enlargement and banquettes.	217 R.	134,019	19.5	do.....	Sept. 9, 1910
145/6-146/15.....	do.....	225 R.	440,000	21.8	Yale & Reagan....	86 per cent.
146/15-147/8.....	do.....	225 R.	227,896	17.5	Roach, Stansell, Lowrance Bros. & Co.	48 per cent.
147/8-148/0.....	Enlargement.....	226 R.	138,768	17.0	W. T. & E. M. Lowrance & Co.	Sept. 19, 1911
150/48-152/45.....	Enlargement and banquettes.	233 R.	218,706	15.0	T. G. Wood.....	July 6, 1916
155/0-157/19.....	Enlargement.....	239 R.	327,224	15.7	Bondurant, Callahan & Cheshire.	Sept. 12, 1911
157/19-160/0.....	do.....	247 R.	277,000	26.0	R. L. Leonard.....	14 per cent.
160/0-161/0.....	do.....	247 R.	84,760	15.0	R. H. & G. A. McWilliams.	July 25, 1910

Condition at the end of fiscal year.—The completed Lower St. Francis levee system will comprise 52,009,000 cubic yards. At the end of the year here had been placed a total of 43,869,142 cubic yards. The system is, therefore, about 84 per cent completed.

Local cooperation.—The best available data suggests a total expenditure to date by local interests of \$9,735,707.59, which includes actual construction, maintenance, high-water charges, right of way, general administration, etc.

Proposed operations.—A continuation of the enlargement in grade and section of the existing line to the extent and at the rate that funds are made available. About 16 per cent of the project remains to be completed.

Effect of improvement.—Practically the entire basin is protected from overflow against ordinary floods.

Summary of yardage in place.

Provided by—	In place May 31, 1916.	Added during year.	In place May 31, 1917.	Under contract May 31, 1917.	Required to complete.
	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>	<i>Cu. yards.</i>
United States.....	17,343,510	869,119	18,212,629	744,646	} 8,139,858
Levee boards.....	23,393,483	2,263,030	25,656,513	221,530	
Total.....	40,736,993	3,132,149	43,869,142	966,176	8,139,858

Plates Nos. 17 and 18 accompany, showing present levee grades with relation to the established project grade.

(d) Upper Yazoo district.

Location.—This district is on the left bank of the river, and comprises the upper end of the State of Mississippi, from 244 to 365 miles below Cairo. The district's area is about 3,281 square miles.

Original condition.—The Mississippi River Commission first undertook levee work in this district in 1882, following the disastrous flood of that year. At the time of this flood the Upper Yazoo levee line was continuous from the Chickasaw Bluffs, below Memphis, south for a distance of about 117 miles. The line, however, was largely a coordination of plantation levees ununiform as to grade and section, and described at the time as being merely "up to low grade."

The flood of 1882 resulted in three crevasses of magnitude—at Parkers, Lake Charles, and Garth—in numerous small breaks, and much loss incident to crop wash. The original condition of this system may, therefore, be briefly summarized as a levee line of 117 miles, capable of protecting the Upper Yazoo basin from but the most moderate floods. It was wholly ineffective, and might as well have been nonexistent for the resistance of any flood waters approximating the stages of 1882, 1883, and 1884, during each of which years the entire basin was covered with the flood waters.

Previous projects.—None.

Existing project.—The existing project is to build and enlarge the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at the present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

Operations and results prior to the fiscal year.—The commission undertook, after the flood of 1882, to assist in the repair and enlargement of the system. Though conditions were not radically improved to meet the floods of 1883 and 1884, during each of which the entire basin was overflowed.

In the high water of 1886 conditions were such that although three small crevasses occurred, but 98 square miles of the basin were flooded. Again, conditions were sufficiently improved to resist the waters of 1890 and 1891, with the exception of one crevasse in each year, the area overflowed in 1890 amounting to but 50 square miles and in 1891 but 17 square miles.

The levees had been strengthened to fully resist the floods of 1892 and 1893, during which no crevasses were experienced.

By the flood of 1897, which practically equaled the Cairo stage of the flood of 1882, the system had rounded into an almost safe condition, so that but one crevasse resulted, flooding a total area of but 342 square miles. The commission and the local board had been working to levee grades 4 to 5 feet above the flood stages of 1882, though it is stated that upon the advent of the water of 1897 "a considerable portion of the line was still below grade 1 to 3 feet."

Since 1897 the most energetic and effective efforts have been applied to this system by the local board, assisted up to about 1908 by the commission, with the sole exception of its cooperation with the local board in the construction of the Sunflower loop in 1910-11. With the exception noted, no Federal expenditure has been made in this district for levee purposes since 1908.

The result has been gratifying, to the extent that the record floods of 1912 and 1913 were passed without crevasses and with but reasonable expenditures by the local board for precautionary measures.

Prior to the fiscal year the total Federal expenditure in this district for levee purposes has amounted to \$1,468,703.45.

Operations and results during the fiscal year.—The United States made no levee expenditure in the Upper Yazoo Basin during the year. The levee board added to the system 1,622,783 cubic yards.

Condition at the end of fiscal year.—The completed system will comprise a total of 41,632,000 cubic yards, of which 38,106,392 cubic yards, or about 91 per cent, are in place.

Local cooperation.—The Upper Yazoo Levee Board has expended to date a total of \$12,965,226.69, which comprehends all costs of construction, maintenance, high-water expenditures, right of way, administration, etc. The present outlook is that no further Federal expenditure will be required, the resources of the local board being such as to fully provide for the district's needs.

Proposed operations.—None.

About 91 per cent of the project is completed. The balance will, in all probability, be provided for by local interests.

Effect of improvement.—The Upper Yazoo Basin has been made entirely safe against all floods, except, perhaps, the extremest. In the event of the latter, vigorous emergency work will in all likelihood prevent crevasse of the system or overflow of the basin.

Summary of yardage in place.

Provided by—	In place May 31, 1916.	Added during years.	In place May 31, 1917.	Under con- tract May 31, 1917.	Required to complete.
United States.....	<i>Cu. yds.</i> 7,686,756	<i>Cu. yds.</i>	<i>Cu. yds.</i> 7,686,756	<i>Cu. yds.</i>	<i>Cu. yds.</i>
Levee boards.....	29,208,253	1,622,783	30,419,636	3,087,624	3,525,600
Total.....	36,895,009	1,622,783	38,106,392	3,087,624	3,525,600

¹ 411,400 cubic yards thrown out by new loops at Norfolk and Commerce Landings deducted from yardage in place.

Plates Nos. 20 and 21 accompany, showing present levee grades with relation to the established project grade.

(e) White River district.

Location.—On the right bank of the river from Helena, Ark., to and including a part of Laconia Circle, from 306 to 385 miles below Cairo. The area of the basin amounts to 910 square miles.

Original condition.—The first expenditure of the United States in the White River district was made in 1887, at which time it is stated that 30 miles of levee "built to low grade" were in existence. These 30 miles presumably comprised a stretch of levee from Helena south, another from the vicinity of Laconia north, and such intermediate plantation levees as were considered to be of any value.

There is no reliable record of the location or condition of the White River levees at the time in question. It is reported that the entire basin was over-

lowed in the floods of 1882, 1883, and 1884, but that about 400 square miles were unaffected by the flood of 1886.

Previous projects.—None.

Existing project.—The existing project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1887. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local boards to the grade and section adopted by the Mississippi River Commission, April 19, 1914.

Operations and results prior to the fiscal year.—In 1887, under a first allotment of \$75,000 by the Mississippi River Commission, the enlargement of the White River system from Helena south was commenced. It is stated that in that year, in cooperation with the local authorities, about 14½ miles of levee were enlarged. The grade adopted was "2 feet above the high water of 1886—the highest in this section."

Construction and enlargement proceeded from Helena south and from Laconia north to a closure just prior to the high water of 1897. The line was wholly insufficient, however, to restrain the flood of that year, so that 14 crevasses occurred, of an aggregate length of 16,420 feet, and the entire basin was overflowed.

These crevasses were not all finally closed until 1905, though Federal and local expenditures for their closure and for the enlargement of portions of the system were made in the meantime. In this regard it was stated "the levee in this district was generally low, particularly in the lower half of the district, where the greater part is below the recent flood and had to be topped, and until the levee is considerably enlarged it is not deemed advisable to close the 1897 breaks." The flood of 1903, passing through the old crevasses, still unclosed, overflowed 768 square miles of the basin. The moderate flood of 1906 was passed without incident.

The system successfully resisted the flood of 1907, and thus remained intact until the flood of 1912, when two large and four small crevasses, aggregating a length of 6,595 feet, occurred with resultant overflow of 850 square miles of the district. These 1912 crevasses were promptly closed and the system was again continuous upon the advent of the 1913 flood, as to which, by vigorous emergency measures, breaks were prevented from Helena south to Knowltons, a distance of 52 miles. Below and including the Knowltons break four crevasses of size were experienced, with considerable damage to the entire Laconia Circle Levee, incident to small breaks and top wash.

These 1913 crevasses were closed during the fiscal year 1915.

The total Federal expenditure in the White River district prior to the fiscal year amounted to \$2,914,442.06.

Operations and results during the fiscal year.—The United States enlarged the system during the year by an aggregate of 545,978 cubic yards. In the same period the local levee boards have provided 372,789 cubic yards in enlargement and banquette. The expenditure of the United States during the year has been \$113,458.49, and that of the local levee boards \$186,277.

Contracts in force at the beginning of the year and those since executed are given in the following table, wherein is shown the date, or per cent, of completion of each:

Location.	Class.	Miles below Cairo.	Cubic yards.	Price.	Contractor.	Date of completion and per cent completed May 31, 1917.
				Cents.		
10-22/32.....	Enlargement.....	327 R	108,480	18.24	Zeb C. Nolan, executor of estate of J. M. Sullivan.	Dec. 31, 1916.
70-28/4.....	do.....	328 R	130,644	16.45	F. L. Carter contract annulled; let to Roach & Stansell.	Nov. 25, 1916.
1/28-31/18.....	New work.....	337 R	250,000	21.30	Rodgers Bros.....	54 per cent.
20-34/0.....	Enlargement.....	342 R	284,000	18.20	do.....	85 per cent.
10-36/0.....	do.....	342 R	300,000	18.20	do.....	79 per cent.
10-37/0.....	do.....	344 R	150,000	29.70	do.....	Not begun.

Conditions at the end of fiscal year.—The White River Levee system completed will total 28,511,000 cubic yards, of which 16,052,663 cubic yards, or about 56 per cent, is in place.

Local cooperation.—The several levee boards concerned with the White River system have expended thereon to date a total of \$1,727,317.40, which includes all costs of construction, maintenance, high water expenditures, rights of way, general administration, etc.

Proposed operations.—Continuation of the enlargement to the project grades and sections of the Mississippi River Commission to the extent and at the rate that funds are made available. About 44 per cent of the project remains to be completed.

Effect of improvement.—The White River basin may be assumed to be fully protected only against moderate floods. Increased protection will accrue at the rate and to the extent that future expenditures provide for the increase of grade and section toward the standards established by the Mississippi River Commission.

Summary of yardage in place.

Provided by—	In place May 31, 1916.	Added during year.	In place May 31, 1917.	Under con- tract May 31, 1917.	Required to complete.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
United States.....	11,425,779	545,978	11,830,149	371,827	12,458,337
Levee boards.....	3,849,725	372,789	4,222,514	122,700	
Total.....	15,275,504	918,767	16,052,663	494,527	12,458,337

¹ 141,608 yards deducted from total, having been thrown out during the year by Fair Loop.

Plate No. 19 accompanies, showing present levee grade with relation to the established project grade.

Flood conditions.—The highest river stages attained at the principal gauge points of these districts throughout the year are shown below:

	Feet.
Cairo, Apr. 4-5.....	50.1
New Madrid, Apr. 5-7.....	39.3
Fulton, Apr. 9.....	37.2
Memphis, Apr. 10.....	40.4
Mhoons, Apr. 10-12.....	42.3
Helena, Apr. 12-13.....	49.9
Mouth White River, Apr. 14-18.....	51.6

Precautionary patrol and distribution of emergency supplies, when necessary, were arranged for by the local authorities throughout all levee districts. The flood was passed without damage to the levee systems or expense to the United States Government.

Levee situation in general.—The following table briefly summarizes conditions and future requirements of the several levee systems within the first and second districts:

Levee district.	Lost or abandoned during year.	Contents, 1917.	Required to complete.	Estimated final contents.	Per cent now built.	Approximate area protected.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>		<i>Sq. miles.</i>
Upper St. Francis.....		6,381,303	7,913,136	14,294,439	44	700
Lower St. Francis.....		43,869,142	8,139,858	52,009,000	84	3,500
White River.....	141,608	16,052,663	12,458,337	28,511,000	67	910
Reelfoot.....		2,719,368	1,308,632	4,028,000	56	310
Upper Yazoo.....	411,400	38,106,392	3,525,608	41,632,000	91	3,281

V. SURVEYS.

Revetment surveys.—The annual surveys were made between September 11, 1916, and June 12, 1917.

The original base lines were retraced and soundings taken on fixed ranges 200 feet apart; in each bend where revetment had been placed shore lines were

above and below the work as far as active caving was encountered; soundings were also made on fixed ranges 1,000 to 1,500 feet apart within these reaches.

The detailed information developed by these surveys will be found in the several paragraphs relating torevetment conditions.

Reach and bank line surveys.—The following reaches were surveyed: Slough Landing Neck, Ky. and Tenn. (55–65 L.); New Madrid Bend and Point Pleasant Reach (65–85 L. and R.); Gayoso Bend and Caruthersville, Mo. (100–115 L.); Barfield, Ark. (138–145 R.); Plum Point (147–168 L. and R.); Golden Lake, Ark. (190–200 R.); Memphis, Tenn. (221–240 L. and R.); Star Landing, Miss., and Porter Lake, Ark. (255–265 L. and R.); Walnut Bend, Ark. (281 R.); Totters Point, Miss., and Helena, Ark. (303–310 L. and R.); Delta, Miss. (312–316 L.); Oldtown, Ark. (323–328 R.); Sunflower, Miss. (350–358 L.).

Bank lines were secured throughout the following unrevetted reaches, to the end of compiling information as to their future revetment or other requirements: Hickman, Ky. (38–44 L.); Bend of Island 8, Mo. (45–50 R.); Stewarts Landing, Mo. (90–93 R.); Bells Point, Mo. (112 R.); Cottonwood Point, Mo. (22 R.); Huffman, Ark. (128–133 R.); Pecan Point, Ark. (196 R.); Hopefield Point, Ark., to Wyanoka, Ark. (230–240 R.); Graves Bayou to Cat Island, Ark. (50–254 R.); Commerce, Miss. (263–266 L.); Mhoon Bend, Miss. (275–280 L.); Fox Island Bend, Miss. (285–290 L.); Hardius Point, Ark. (290 R.); O. K. Bend, Miss. (291–295 L.); St. Francis Bend, Ark. (293–298 R.); Friar Point, Miss. (317–320 L.); Dawson, Ark., to Offuts, Ark. (343–346 R.); Sunflower, Miss., to Lake Charles, Miss. (352–357 L.).

In addition to the annual surveys described above, a survey was made in compliance with a resolution of the Mississippi River Commission of the Ohio River from the Cairo City elevator up to the mouth of the Cache River, with a view of determining the rate of bank caving and the extent of scour in the river.

This survey was made between September 16 and 27, 1916. The report and maps were submitted to the president Mississippi River Commission on November 1, 1916.

VI. PLANT.

New plant.—The following additions to plant have been made during the year at the costs indicated:

<i>As. 1701 to 1707, inclusive, creosoted wooden material barges (under construction). Construction cost during the year</i> -----	\$31,928.23
<i>As. 1708 and 1709, creosoted wooden flats (under construction). Construction cost during the year</i> -----	1,570.65
<i>As. 1711 to 1713, inclusive, creosoted wooden concrete mat barges (under construction). Construction cost during the year</i> -----	7,490.83
<i>As. 1714 to 1719, inclusive, creosoted wooden sand barges (under construction). Construction cost during the year</i> -----	4,066.77
<i>A. 1208, floating concrete mixing plant (alterations and additions). Completed at a total cost during the year</i> -----	16,079.02
<i>Steamer Wyanoka (by transfer)</i> -----	20,000.00
<i>As. 2, 3, 5, 6, quarterboats (by transfer)</i> -----	12,000.00
<i>A. 4, pile driver (by transfer)</i> -----	1,800.00
<i>As. 122, 126, 128, 131, 133, 134, 135, 137, 212, 214, 216, 217, barges (by transfer)</i> -----	18,000.00
<i>Skiers, steamer Minnetonka (purchased)</i> -----	1,500.00
<i>Siffs, five purchased</i> -----	206.98
<i>Tools and appliances, outfits, etc</i> -----	9,749.28
<i>Expended material on hand</i> -----	2,813.10
Total -----	127,204.86
<i>Concrete revetment plant (machinery for plant is now under contract)</i> -----	28,740.00
<i>Timber and miscellaneous material (under contract for completion of barges)</i> -----	30,160.04

Plant decreased.—The plant has been decreased during the year by the following items:

Dropped by inventory and inspection: Barges No. 9305, No. 9317, No. 9323, A. 9326, No. 9328, No. 0502, and model barge No. 9407.

Dropped on affidavit: Hydraulic grader No. 9313 and skiff No. 17.

Repairs to plant.—Repairs to the following items of plant have been made during the year at the costs stated:

Steamer <i>Minnetonka</i> : Side stokers installed; furnace arches and walls rebuilt; boilers repaired; new stacks built; general running repairs-----	\$4, 559. 84
Steamer <i>Wynoka</i> : Received new towing, stationary, and swinging fenders; wheel repaired and rebuilt; straightened pitmans and cylinder beams; rudders repaired; new head block installed; machinery and boilers overhauled; general running repairs-----	2, 790. 96
Steamer <i>Chisca</i> : Received new rudder and rudder stock; new exhaust pipe; new scuppers; repaired larboard cylinder timber; new fantail; new wheel chain brace; repairs to after boiler beam; new mud drum stand foundations; repairs to outriggers, nosing, and plank shear; cabin floor repaired; boiler-deck nosing repaired; fusible plugs renewed in boiler; machinery overhauled; general running repairs-----	1, 468. 91
Steamer <i>Graham</i> : Received new fenders; guards repaired; wheel repaired; minor repairs to machinery; general running repairs-----	810. 35
Steamer <i>Search</i> : Docked; head, sides, and guards rebuilt; bottom calked; machinery repaired and lined up; wheel repaired; general running repairs-----	5, 719. 31
Steamer <i>Itasca</i> : Boat raised, docked, and cleaned; repairs to hull and cabin; machinery overhauled; wheel rebuilt twice; shaft repaired; new pitmans and repairs made to crossheads; general running repairs-----	4, 807. 86
Steamer <i>Augustus J. Nolly</i> : Two new wrist pins made and installed; engines lined up; air pump bushed; capstan engine repaired; cabin repaired; tiller box and wheel repaired; general running repairs-----	1, 031. 60
Steamer <i>W. M. Rees</i> : New feed-water heater installed; Snowden heaters overhauled and repaired; bushing renewed in air pump; wheel repaired; circulating pump overhauled; general running repairs-----	1, 090. 10
Steamer <i>Maude Kilgore</i> : Cylinder timbers repaired; repairs to speaking tubes and wheel; new bunks installed; general running repairs-----	228. 46
Steamer <i>Mercury</i> : Received minor repairs-----	20. 67
Steamer <i>Saturn</i> : Received minor repairs-----	47. 83
Steamer <i>Venus</i> : Received minor repairs-----	35. 00
Dredge <i>Iota</i> : New discharge-pipe straps made; minor repairs-----	78. 19
Launch <i>Opelika</i> : Motors, generator, and heating system overhauled; screens and roof renewed; new piston rings and propellers installed; general running repairs-----	2, 386. 80
Hydraulic grader <i>No. 1022</i> : Minor repairs to discharge valves-----	46. 40
Hydraulic grader <i>No. 1205</i> : Addition to cabin built; turbines and pumps and electric light plant repaired; minor repairs to valves-----	1, 926. 76
Hydraulic grader <i>No. 1401</i> : Pumps and light plant overhauled; minor repairs-----	552. 68
Sand and gravel digger <i>No. 1407</i> : Minor repairs to pump-----	16. 72
Concrete mixing plant <i>No. 1208</i> : Purchased under contract of steel pontoon; taken out on ways and pontoon connected to hull; old derrick and bins removed; new bins, sand elevator, sack elevator, and nigger boiler erected; steam capstans installed-----	16, 601. 33
Derrick boat <i>No. 3</i> : New steel stiff legs built and erected, cabin repaired, machinery overhauled, new flues put in boiler-----	942. 00
Derrick boat <i>No. 1017</i> : Minor repairs made to engine-----	22. 43
Derrick boat <i>No. 1411</i> : Steel mast repaired, hoisting engine overhauled-----	467. 12
Pile driver <i>No. 4</i> : Received minor repairs to hull-----	4. 30
Machine shop <i>No. 1</i> : Work on new boiler completed and boiler erected, hog chains and braces installed, cabin and guards repaired, steam pipe covered, repairs to feed pump, general repairs-----	2, 802. 10
Floating dock: Repairs made to top gunwale strake, gates repaired and calked, minor repairs-----	132. 20
Coal loader <i>No. 9309</i> : Sides and rakes calked afloat-----	65. 10

Locomotive Crane: General repairs to engines; new flues installed in boiler; driving gear repaired	\$951.89
Creosote Tanks: Tanks repaired; pipe line tightened up; boiler repaired and fusible plugs renewed; tank coils repaired	108.17
Quarterboat No. 5: Received new fenders; guards repaired; stoves and ranges repaired	157.16
Quarterboat No. 6: Minor repairs to hot-water boiler	25.50
Quarterboat No. 8: Received new timberheads; repairs made to cabin, guards, and stovepipes; sides and rakes calked afloat	196.42
Quarterboat No. 11: Roof repaired; repairs made to guards	31.25
Quarterboat No. 12: New roof put on; new timberheads installed; repairs made to guards; sides and rakes calked afloat	852.66
Quarterboat No. 25: Received minor repairs	40.35
Carpenter shop No. 26: Docked; repairs made to bottom, sides, rakes, and guards	1,834.88
Quarterboat No. 27: Work on new hull completed; cabin transferred; minor repairs to cabin; toilet fixtures overhauled	2,450.33
Quarterboat No. 0601: Toilet fixtures installed; repairs to cabin, stoves, and ranges	231.41
Quarterboat No. 1020: Received new stationary fenders; guards, stoves, and ranges repaired	215.50
Quarterboat No. 1021: Received minor repairs	66.65
Barge mattress No. 5: Docked; repairs made to hull and ways; new stanchions put in and repairs made to bottom; hull calked	483.45
Barge mattress No. 6: Docked; side straightened; repairs made to bottom, ways, and fingers; hull calked	478.12
Barge mattress No. 9312: Received minor repairs	62.54
Barge mattress No. 0703: Received minor repairs to ways	60.04
Barge mattress No. 1501: Ways rebuilt	1,152.57
Barge mattress No. 1502: Ways rebuilt	1,090.44
Barge, mooring, No. 1: Sides and rakes calked afloat	46.80
Barge, mooring, No. 1224: Received minor repairs	28.74
Barge, mooring, No. 1225: Received minor repairs	35.33
Barge, model, No. 122: Sides patched and minor repairs	61.25
Barge, model, No. 133: Docked; side patched; bottom calked	175.38
Barge, model, No. 214: Minor repairs; barge sunk	12.53
Barge No. 9315: Deck patched; rakes calked	190.20
Barge No. 9319: Deck patched; sides and rakes calked	190.20
Barge 9325: Deck patched; sides and rakes calked	148.00
Barge No. 0805: Docked; rakes patched; sides and rakes calked	429.70
Barge No. 0806: Repairs to air compressor and boiler; sides and rakes calked	187.12
Barge No. 0807: Received minor repairs	37.63
Barge No. 0809: Fascine platform built; rakes calked	105.86
Barge No. 1004: Cement storage house built	475.91
Barge No. 1009: Dismantling machinery; patching deck; rakes and sides calked afloat	508.31
Barge No. 1101: Sand bins erected; sides and rakes calked	199.97
Barge No. 1201: Cement storage house built	499.90
Barge No. 1202: Scraping and painting hull	13.75
Barge No. 1305: Received new tie rods and timberheads; rakes and sides calked	436.08
Barge No. 1307: Received minor repairs	22.17
Barge No. 1310: Docked; hull scraped and painted	109.35
Barge No. 1316: Docked; hull scraped and painted	124.71
Barge flat No. 4: Sides, rakes, and deck repaired	316.67
Talking flat No. 1: Rebuilt	58.80
Skiffs: Overhauled	270.00
Miscellaneous: Repairs were made to tools and appliances at various times, for construction parties and fleet use; repairs to ranges, stoves, wheelbarrows, pumps, furniture, etc	2,441.88
Total	66,270.80

The following shows the original cost, the repair, and depreciation during the year, and the present estimated value of all plant employed in the first and second Mississippi River districts:

Name.	No.	Original cost.	Valuation last year.	Repairs.	Depreciation.	Present value.
Barge, model.....	1	\$3,847.00	\$1,500.00	\$61.25	\$230.82	\$1,330.43
Do.....	1	2,885.00	1,500.00	.....	173.10	1,326.90
Do.....	1	3,580.00	1,500.00	.....	215.40	1,284.60
Do.....	1	3,500.00	1,500.00	.....	215.40	1,284.60
Do.....	1	3,650.00	1,500.00	175.38	219.00	1,456.38
Do.....	1	3,650.00	1,500.00	.....	219.00	1,281.00
Do.....	1	3,650.00	1,500.00	.....	219.00	1,281.00
Do.....	1	3,650.00	1,500.00	.....	219.00	1,281.00
Do.....	1	3,800.00	1,500.00	.....	228.00	1,272.00
Do.....	1	3,597.00	1,500.00	12.53	215.82	1,296.71
Do.....	1	3,597.00	1,500.00	.....	215.82	1,284.18
Do.....	1	3,597.00	1,500.00	.....	215.82	1,284.18
Barge (coal loader).....	1	3,170.00	3,547.47	65.10	158.50	3,454.07
Barge, decked.....	1	3,170.00	.....	190.20	190.20	.....
Do.....	1	3,170.00	2,905.90	.....	190.20	2,715.70
Do.....	1	3,170.00	.....	190.20	190.20	.....
Do.....	1	2,466.67	.....	148.00	148.00	.....
Do.....	1	2,466.66	2,331.38	.....	148.00	2,183.38
Do.....	1	5,727.53	3,231.97	.....	286.38	2,945.59
Do.....	1	5,727.53	3,140.87	.....	286.38	2,854.49
Do.....	1	5,727.53	3,317.07	.....	286.38	3,030.69
Do.....	1	5,727.53	3,171.37	.....	286.38	2,884.99
Do.....	1	3,531.50	685.62	429.70	211.89	903.43
Do.....	1	3,531.51	997.84	187.12	211.89	973.07
Do.....	1	5,624.70	1,825.01	37.63	281.24	1,581.40
Do.....	1	5,624.70	1,803.69	.....	281.24	1,522.45
Do.....	1	5,624.70	1,772.98	105.86	281.24	1,597.60
Do.....	1	5,727.53	3,140.59	.....	286.38	2,854.21
Do.....	1	5,569.58	3,195.66	.....	278.48	2,917.18
Do.....	1	5,569.58	3,222.52	.....	278.48	2,944.04
Do.....	1	4,212.00	3,119.31	.....	212.10	2,907.21
Do.....	1	4,212.00	3,006.95	.....	212.10	2,794.85
Do.....	1	4,212.00	3,015.35	.....	212.10	2,803.25
Do.....	1	4,212.00	3,032.15	475.91	212.10	3,295.96
Do.....	1	4,050.00	3,106.39	.....	202.50	2,903.89
Do.....	1	1,050.00	3,031.97	.....	202.50	2,829.47
Do.....	1	4,246.58	3,231.44	.....	212.33	3,019.11
Do.....	1	4,246.58	3,144.94	.....	212.33	2,932.61
Do.....	1	4,246.58	3,307.82	508.31	212.33	3,603.80
Do.....	1	4,246.58	3,148.10	.....	212.33	2,935.77
Do.....	1	4,246.58	3,205.99	.....	212.33	2,993.66
Do.....	1	4,246.58	3,111.90	.....	212.33	2,929.57
Do.....	1	4,300.00	3,276.58	199.97	215.00	3,261.55
Barge, steel.....	1	8,900.00	7,424.47	499.90	356.00	7,568.37
Do.....	1	8,900.00	7,279.38	13.75	356.00	6,937.13
Do.....	1	8,900.00	7,372.34	.....	356.00	7,016.34
Do.....	1	8,900.00	7,331.99	.....	356.00	6,975.99
Do.....	1	8,900.00	7,362.63	.....	356.00	7,006.63
Do.....	1	8,900.00	7,334.73	.....	356.00	6,978.73
Do.....	1	8,900.00	7,309.74	.....	356.00	6,953.74
Do.....	1	8,900.00	7,432.12	.....	356.00	7,076.12
Do.....	1	8,900.00	7,121.62	.....	356.00	6,765.62
Do.....	1	8,900.00	7,121.62	.....	356.00	6,765.62
Do.....	1	8,900.00	7,401.62	.....	356.00	7,045.62
Barge, decked.....	1	4,194.00	3,391.37	.....	209.70	3,181.67
Do.....	1	4,194.00	3,530.57	.....	209.70	3,320.87
Do.....	1	4,194.00	3,284.27	.....	209.70	3,074.57
Do.....	1	4,194.00	3,358.40	.....	209.70	3,148.70
Do.....	1	4,194.00	3,226.85	.....	209.70	3,017.15
Do.....	1	4,194.00	3,303.15	.....	209.70	3,093.45
Do.....	1	4,194.00	3,313.73	.....	209.70	3,104.03
Do.....	1	4,773.15	3,944.89	.....	238.66	3,706.23
Do.....	1	4,773.15	3,818.53	.....	238.66	3,579.87
Do.....	1	4,773.15	3,900.44	.....	238.66	3,661.78
Do.....	1	4,773.15	3,896.74	436.08	238.66	4,094.16
Do.....	1	4,773.15	3,859.74	.....	238.66	3,621.08
Barge, steel.....	1	8,500.00	7,249.00	22.17	340.00	6,931.17
Do.....	1	8,500.00	7,258.36	.....	340.00	6,913.36
Do.....	1	8,500.00	7,249.00	.....	340.00	6,909.00
Do.....	1	8,500.00	7,249.00	109.35	340.00	7,018.35
Do.....	1	8,500.00	7,249.00	.....	340.00	6,909.00
Do.....	1	8,500.00	7,249.00	.....	340.00	6,909.00
Do.....	1	8,500.00	7,249.00	124.71	340.00	7,033.71
Do.....	1	8,500.00	7,249.00	.....	340.00	6,909.00
Do.....	1	8,500.00	7,249.00	.....	340.00	6,909.00
Barge, decked.....	1	4,500.00	3,965.83	.....	225.00	3,740.83
Do.....	1	4,500.00	4,063.88	.....	225.00	3,838.88
Do.....	1	4,500.00	4,273.24	.....	225.00	4,048.24
Do.....	1	4,500.00	3,933.57	.....	225.00	3,708.57
Do.....	1	4,500.00	3,974.51	.....	225.00	3,749.51
Do.....	1	4,500.00	3,924.87	.....	225.00	3,699.87
Do.....	1	4,500.00	4,063.35	.....	225.00	3,838.35

1 Sunk; will be dropped on affidavit.

Name.	No.	Original cost.	Valuation last year.	Repairs.	Depreciation.	Present value.
erge, mattress.....	1	\$4,530.00	\$2,533.19	\$483.45	\$226.50	\$2,790.14
Do.....	1	4,530.00	2,488.01	478.12	226.50	2,739.63
Do.....	1	2,800.00	5,404.66		140.00	5,264.66
Do.....	1	2,800.00	5,520.23	62.54	140.00	5,442.77
Do.....	1	5,120.00	4,094.37		256.00	3,838.37
Do.....	1	5,120.00	4,269.11	60.04	256.00	4,073.15
Do.....	1	4,642.91	3,567.14		232.15	3,334.99
Do.....	1	4,642.91	3,566.58		232.15	3,334.43
Do.....	1	6,992.03	5,873.34	1,152.57	349.60	6,676.31
Do.....	1	6,992.02	5,873.33	1,090.44	349.60	6,614.17
erge, mooring.....	1	2,023.00	611.63	46.80	121.38	537.05
Do.....	1	2,023.00	612.42		121.38	491.04
Do.....	1	3,560.00	2,641.97		178.00	2,463.97
Do.....	1	3,780.00	2,788.71		189.00	2,599.71
Do.....	1	3,560.00	2,652.91	28.74	178.00	2,503.65
Do.....	1	3,780.00	2,795.78	35.33	189.00	2,642.11
erge, flat.....	1	460.00		316.67	23.00	293.67
Do.....	1	499.80	402.01		24.99	377.02
Do.....	1	743.04	606.81		37.15	569.66
Do.....	1	743.04	612.62		37.15	575.47
Do.....	1	743.04	618.05		37.15	580.90
rick boats.						
No. 3.....	1	2,956.00	4,488.93	942.06	177.36	5,253.63
No. 1017.....	1	5,959.40	4,539.04	22.45	297.97	4,263.52
No. 1411.....	1	8,481.70	8,060.50	467.13	424.09	8,103.54
arterboats:						
No. 2.....	1	5,200.00	3,000.00		312.00	2,688.00
No. 3.....	1	5,200.00	3,000.00		312.00	2,688.00
No. 5.....	1	5,200.00	3,000.00	157.16	312.00	2,845.16
No. 6.....	1	5,200.00	3,000.00	25.50	312.00	2,713.50
No. 8.....	1	3,645.00	2,670.01	196.42	218.30	2,648.13
No. 11.....	1	3,645.00	1,621.89	31.25	218.30	1,434.84
No. 12.....	1	3,645.00	2,747.06	852.66	218.30	3,381.42
No. 25.....	1	3,645.00	1,271.74	40.35	218.30	1,093.79
No. 26.....	1	3,645.00	1,780.98	1,834.88	218.30	3,397.56
No. 27.....	1	2,788.00	1,711.85	2,450.33	139.40	4,022.78
Amelia.....	1	2,741.00	1,433.11		164.46	1,268.65
No. 206.....	1	4,900.00	3,720.31		245.00	3,475.31
No. 221.....	1	4,900.00	4,142.65		245.00	3,897.65
No. 0601.....	1	3,059.00	2,034.17	231.41	152.95	2,112.63
No. 1020.....	1	9,889.11	6,485.63	215.50	494.46	6,206.67
No. 1021.....	1	9,889.11	6,486.61	66.65	494.46	6,058.80
No. 1301.....	1	5,800.00	4,665.19		290.00	4,375.19
No. 1402.....	1	10,399.94	8,365.42		520.00	7,845.42
draulic graders:						
No. 2.....	1	30,232.00				(1)
No. 9313.....	1	9,212.00	1,085.22		1,085.22	(2)
No. 1022.....	1	15,900.00	12,734.57	46.40	795.00	11,985.97
No. 1205.....	1	31,721.07	29,725.52	1,926.76	1,268.84	30,383.44
No. 1401.....	1	32,802.63	29,748.01	552.68	1,312.11	28,988.58
nd digger No. 1407.....	1	13,445.00	12,307.64	16.75	672.25	11,652.14
crete-mixing plant No. 1208.....	1	25,000.00	38,438.58	522.31	1,000.00	37,960.89
ating dock.....	1	9,475.00	1,026.78	132.25	567.50	591.53
chine shop No. 1.....	1	8,501.00	7,279.15	2,802.10	510.06	9,571.19
river No. 4.....	1	4,500.00	1,800.00	4.34	270.00	1,534.34
boats:						
Minnetonka.....	1	40,000.00	23,557.50	3,059.84	2,400.00	24,217.34
Wynoka.....	1	45,672.00	20,000.00	2,790.96	1,826.88	20,964.08
Chisca.....	1	25,900.00	27,995.78	1,468.91	1,554.00	27,910.69
Graham.....	1	9,500.00	20,757.68	810.35	570.00	20,998.03
Search.....	1	9,000.00	6,582.22	5,719.31	540.00	11,761.53
Itasca.....	1	9,500.00	5,099.53	4,807.86	380.00	9,527.39
Augustus J. Nolty.....	1	34,735.00	32,102.26	1,031.60	1,389.40	31,744.46
W. M. Rees.....	1	34,735.00	32,937.14	1,090.10	1,389.40	32,637.84
Maude Kilgore.....	1	(3)		228.46	228.46	
Mercury.....	1	(4)		20.67	20.67	
Saturn.....	1	(4)		47.83	47.83	
Venus.....	1	(4)		35.00	35.00	
dge Iota.....	1	(4)		78.19	78.19	
unch Opelika.....	1	5,000.00	7,974.34	2,386.80	300.00	10,061.14
Sils.....	24	870.00	362.98	270.00	52.25	580.73
Olding flat.....	1	20.00	19.60	58.80	1.20	77.20
its, metallic.....	3	180.00	150.00		7.20	142.80
its, life.....	2	170.00	141.67		6.80	134.87
opstone tanks.....	2	1,347.37	826.54	108.17	53.89	880.82
omotive crane.....	1	7,125.00	6,428.84	951.89	1,187.50	6,193.23
crete revetment plant (dis-						
mantled).....	1	12,163.00	12,163.00		12,000.00	163.00
ols and appliances.....		46,668.43	34,123.71	2,441.88	4,666.84	31,898.75
hair material on hand.....				6,189.14		6,189.14
Total.....		1,082,649.03	814,955.60	54,880.92	66,568.06	803,268.46

1 Will be dropped by inventory and inspection.

2 Sunk; dropped on affidavit.

3 Chartered.

4 Borrowed.

Care of plant.—All the plant employed in these districts was suitably cared for during the year at Memphis, Tenn., at a total expense of \$22,836.37.

Recapitulation.

New plant.....	\$127, 204. 86
Repairs to plant.....	54, 880. 92
Care of plant.....	22, 836. 37
Total.....	204, 922. 15

INCLOSURES.

The following inclosures accompany this report, of which they are parts:

Plate No. 1. First and second districts.

Plate No. 2. Hickman, Ky.¹

Plate No. 3. Slough Landing Neck, New Madrid, Mo.; Point Pleasant Reach.¹

Plate No. 4. Gayoso Bend, Mo.; Caruthersville, Mo.

Plate No. 5. Barfield, Ark.

Plate No. 6. Plum Point Reach, chute of Island 26, Daniels Point, Ashport Bend, Gold Dust, Tenn.; Fletchers Bend, Osceola Front, Ark.; and Bullerton Bar, Ark.¹

Plate No. 7. Golden Lake, Ark.¹

Plate No. 8. Memphis Reach, Hopefield, Memphis Harbor, Tennessee Chute.

Plate No. 9. Star Landing, Miss.; Porter Lake, Ark.

Plate No. 10. Walnut Bend, Ark.¹

Plate No. 11. Helena Reach, Trotters Revetment, Helena Revetment.¹

Plate No. 12. Delta, Miss.

Plate No. 13. Old Town, Ark.

Plate No. 14. Sunflower, Miss.¹

Plate No. 15. Upper St. Francis levee district.

Plate No. 16. Reelfoot levee district.

Plate No. 17. Lower St. Francis levee district No. 1.

Plate No. 18. Lower St. Francis levee district No. 2.

Plate No. 19. White River levee district.

Plate No. 20. Upper Yazoo levee district No. 1.

Plate No. 21. Upper Yazoo levee district No. 2.

Plate No. 22. Overflowed areas.

G. P. HOWELL,

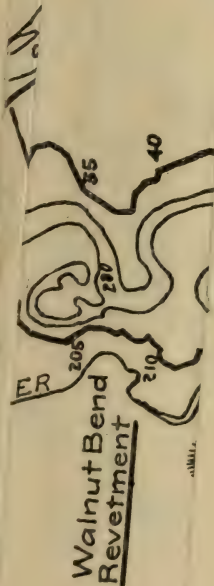
Lieutenant Colonel, Corps of Engineers, United States Army.

Abstract of contracts in force June 30, 1917.

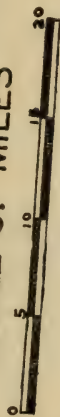
Names of contractors.	Amount and character of work.	Rate per cubic yard.	Date of approval.	Date of beginning work.	Date of expiration of contract.
<i>Upper St. Francis levee district.</i>					
R. L. Leonard.....	124,000 cubic yards levee work, stations 20/16-22/0.	Cents. 21.00	1916. Oct. 25	1916. Nov. 9	1917. Dec. 31
Do.....	200,000 cubic yards levee work, stations 22/0-24/0.	26.95	Oct. 9	Oct. 24	Do.
Do.....	176,000 cubic yards levee work, stations 24/0-26/15.	21.00	Oct. 25	Nov. 9	Do.
Oglesby Construction Co.....	170,000 cubic yards levee work, stations 67/45-68/21.	20.00	1915. Sept. 10	Feb. 10	² Do.
Do.....	115,000 cubic yards levee work, stations 68/21-69/0.	18.00	...do....	...do....	Do.
Do.....	140,000 cubic yards levee work, stations 69/0-69/27.	16.00	...do....	...do....	Do.
Do.....	100,000 cubic yards levee work, stations 69/27-70/0.	13.60	...do....	...do....	Do.
Do.....	102,000 cubic yards levee work, stations 70/0-70/26.	12.00	...do....	...do....	Do.

¹ Not printed.

² Work temporarily suspended.



PREPARED UNDER THE DIRECTION OF
LIEUT. COL. G.P. HOWELL, CORPS OF ENGINEERS, U.S.A.



D.M. BROCK, JR. ENGR.
B.B. BRIER, SURVEYMAN.
Drawn by G.L.A.

Memphis Tenn. May, 1917.

Approved:

G. P. Howell

Lieut. Col., Corps of Engineers, U.S.A.
To accompany annual report 1916-1917.



MISSISSIPPI RIVER COMMISSION
FIRST AND SECOND DISTRICTS
PREPARED UNDER THE DIRECTION OF
LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.

SCALE OF MILES
0 5 10 15 20

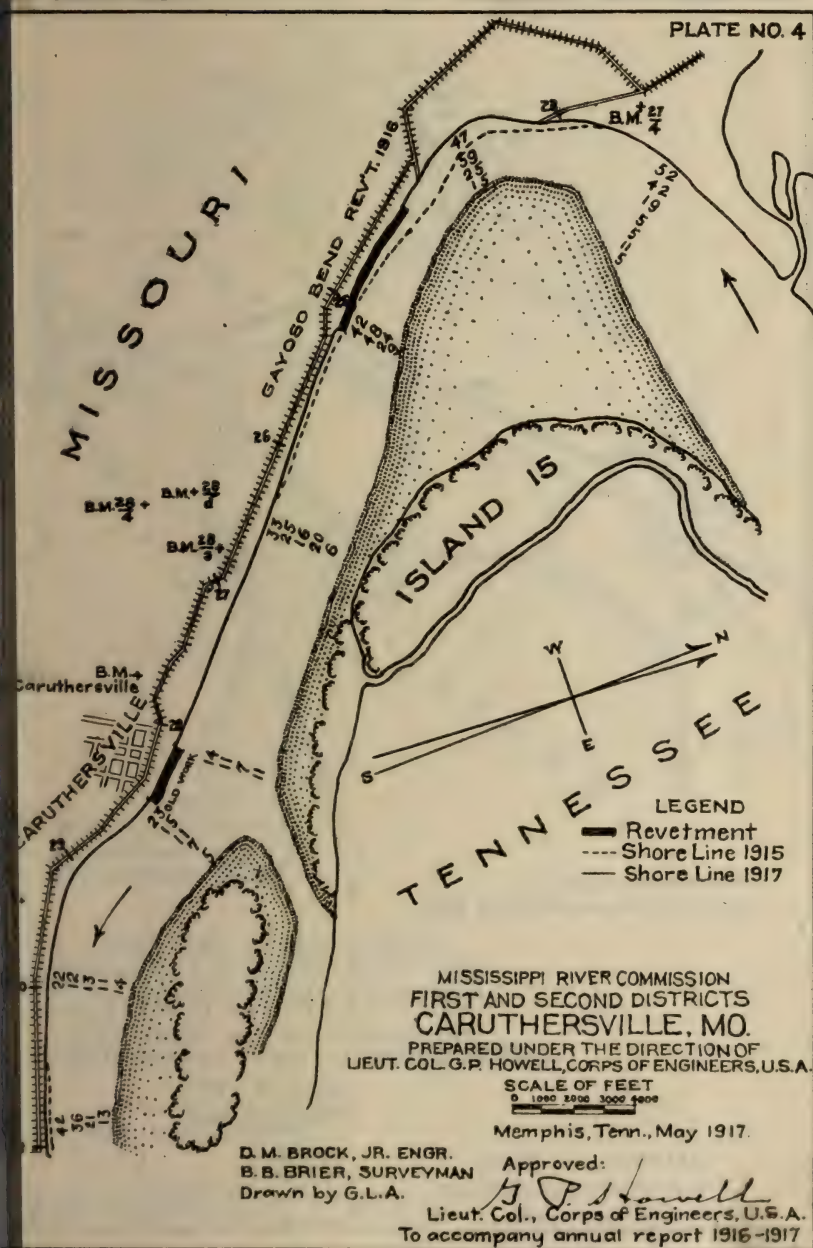
Memphis Tenn. May, 1917.

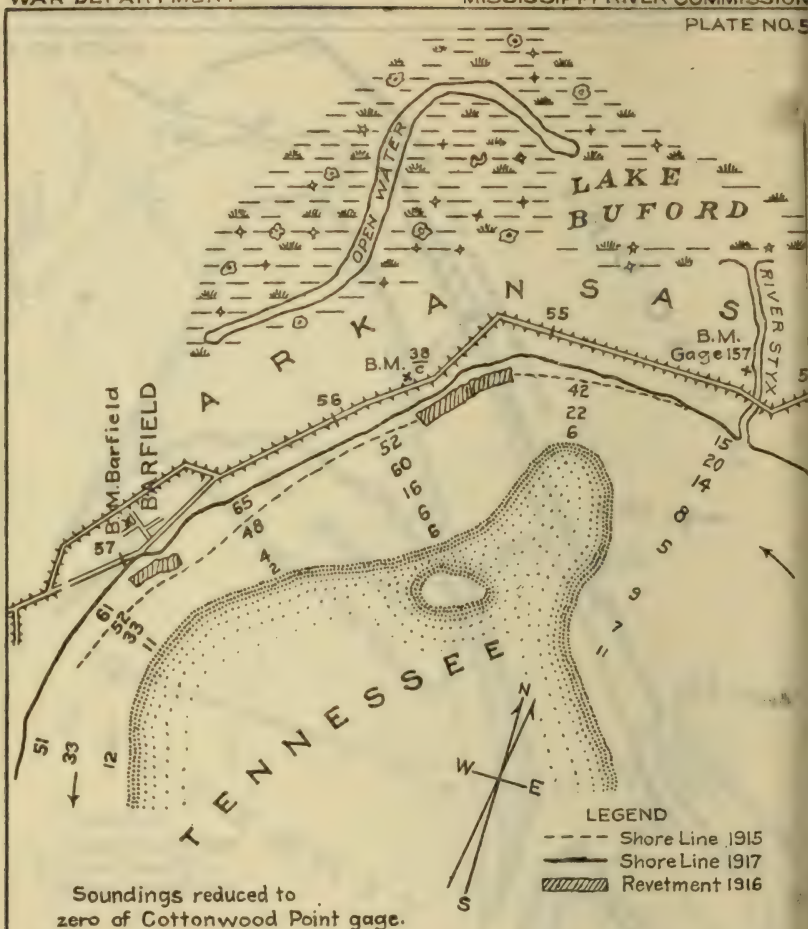
Approved:
G. P. Howell
Lieut. Col., Corps of Engineers, U.S.A.

To accompany annual report 1916-1917.

D. M. BROCK, JR. ENGR.
B. B. BRIER, SURVEYMAN.
Drawn by G. L. A.

PLATE NO. 4





MISSISSIPPI RIVER COMMISSION
FIRST AND SECOND DISTRICTS
RIVER STYX TO BARFIELD

PREPARED UNDER THE DIRECTION OF
 LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.

SCALE OF FEET

0 500 1000 2000 3000

Memphis, Tenn., MAY, 1917.

D. M. BROCK, JR. ENGR.

B. B. BRIER, SURVEYMAN

Drawn by G. L. A.

Approved

G. P. Howell
 Lieut. Col., Corps of Engineers, U.S.A.

To accompany annual report, 1916-1917

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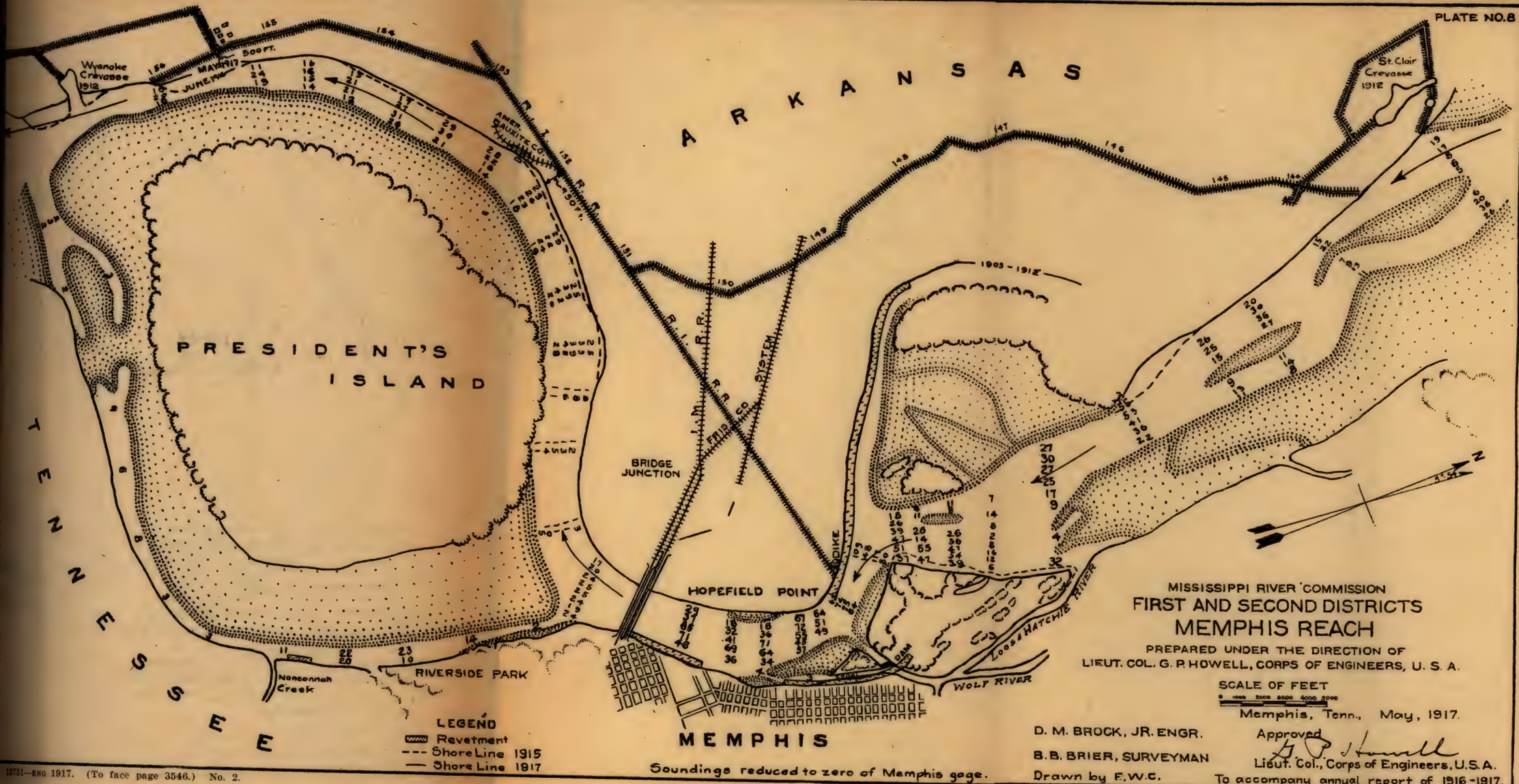


LIEUT. CO

D. M. BROCK, J

B. B. BRIER, SU

Drawn by E. M.

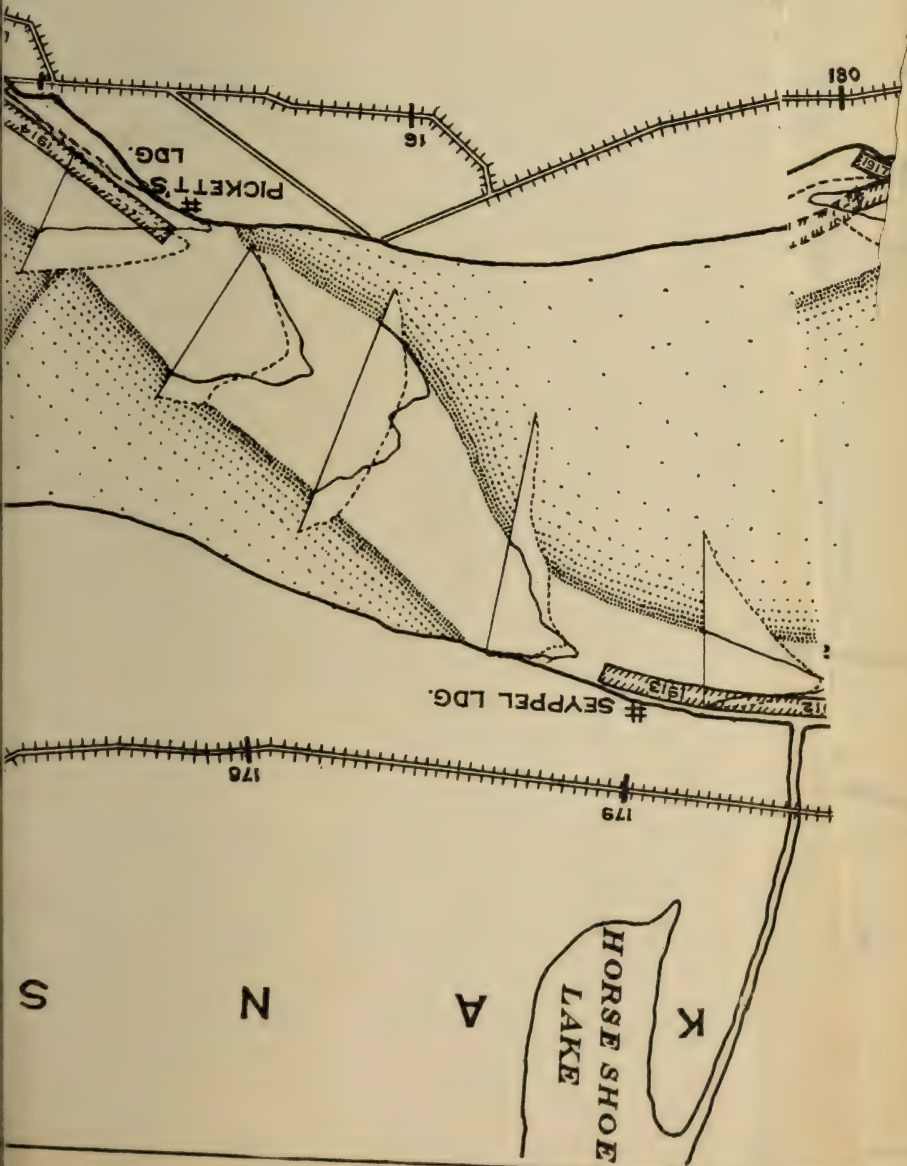


GOOSE LAKE

R

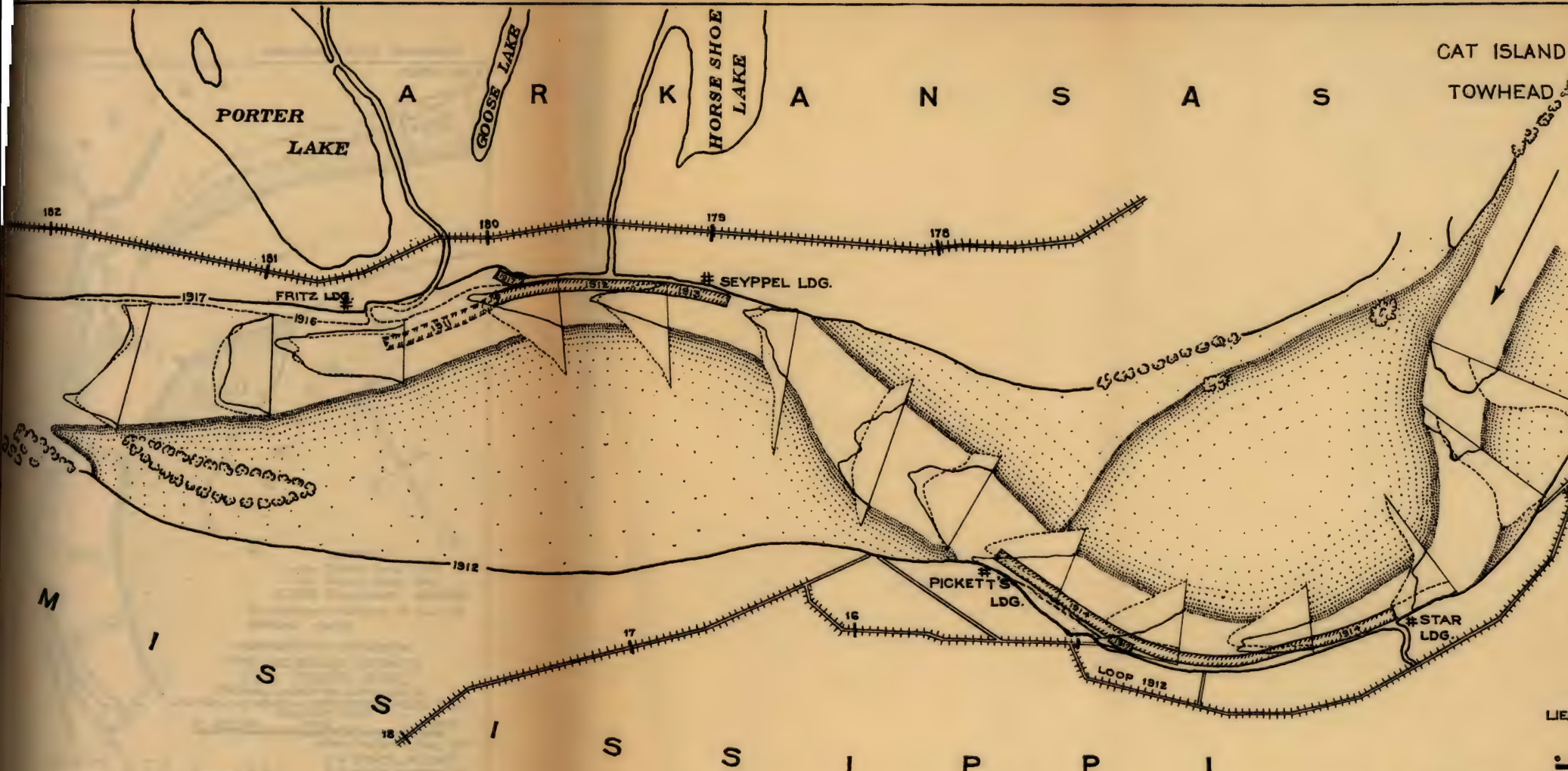
LEGEND  
--- Sections 1915  
--- Sections 1916  
[hatched] Revet  
Soundings reduced to zero of

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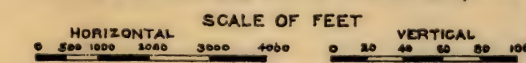


HORSE SHOE  
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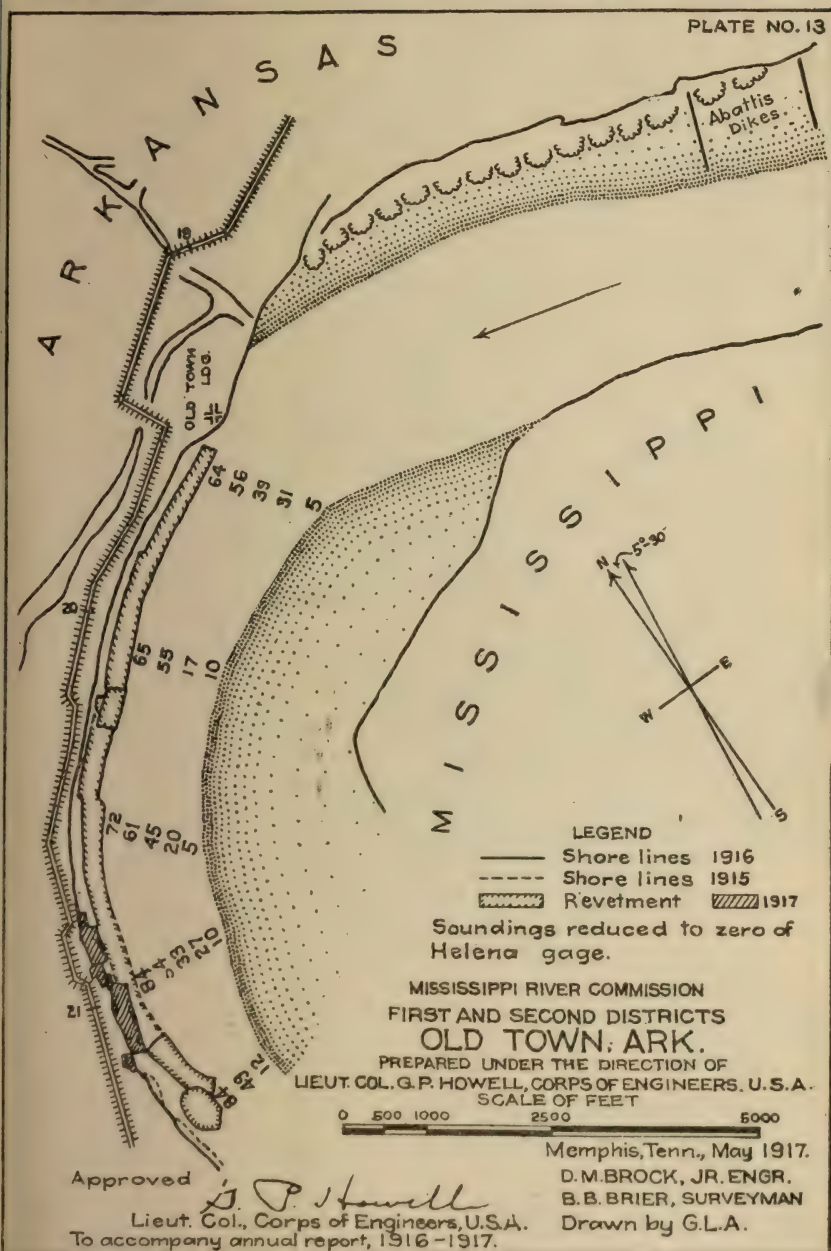


MISSISSIPPI RIVER COMMISSION  
 FIRST AND SECOND DISTRICTS  
 STAR LANDING, MISS.  
 PORTER LAKE, ARK.  
 PREPARED UNDER THE DIRECTION OF  
 LIEUT. COL. G. R. HOWELL, CORPS OF ENGINEERS, U.S.A.



**LEGEND**  
 - - - Sections 1915    Revetment  
 — Sections 1916    Revetment lost.  
 Soundings reduced to zero of Memphis gage.

D.M. BROCK, JR. ENGR.  
 B.B. BRIER, SURVEYMAN  
 Drawn by G.L.A.  
 Approved:   
 G. R. Howell, Lieut. Col., Corps of Engineers, U.S.A.  
 To accompany annual report, 1916-1917.  
 Memphis, Tenn., May, 1917.



LIBRARY

2

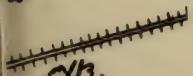
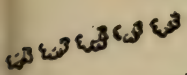
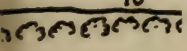
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904



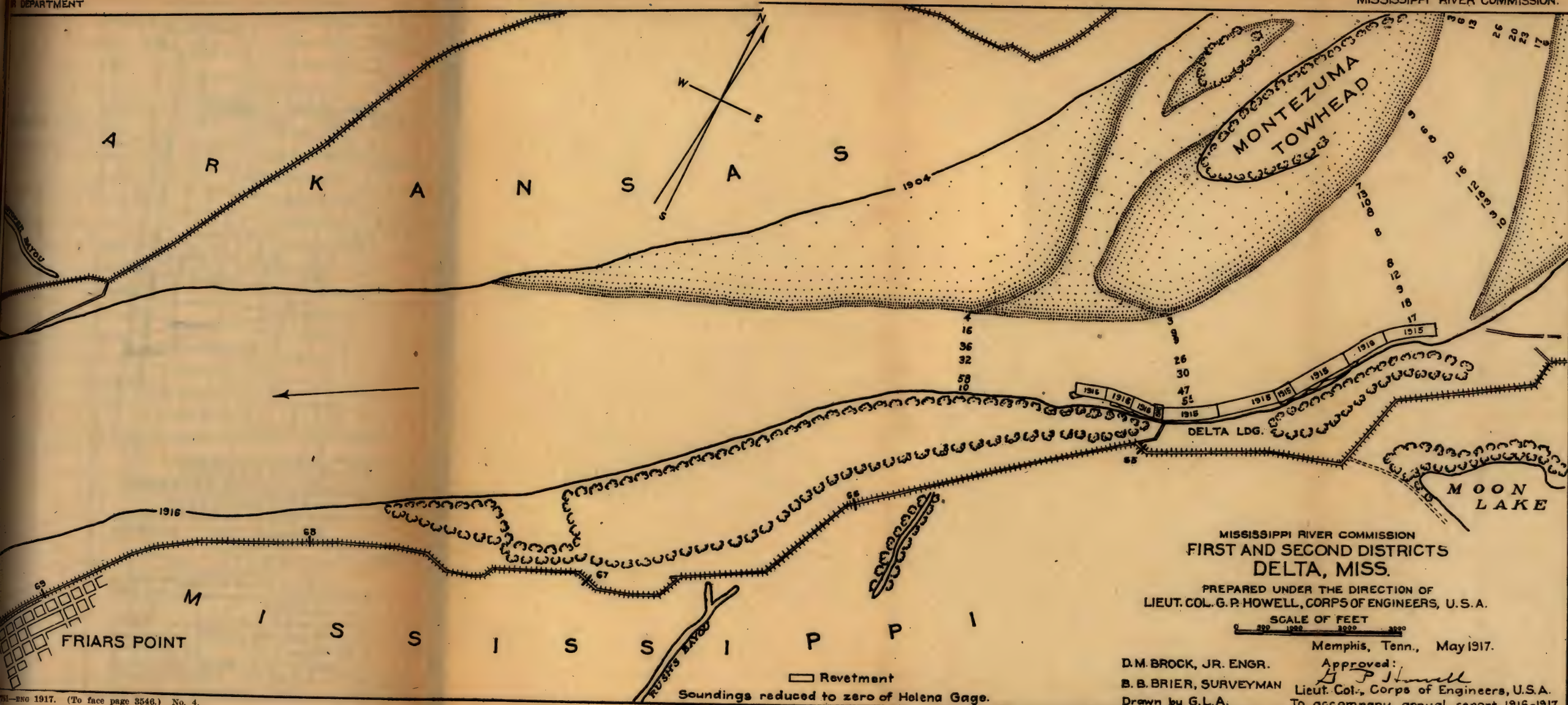
4  
16  
36  
32  
58  
10



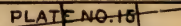
1

Helena Gage

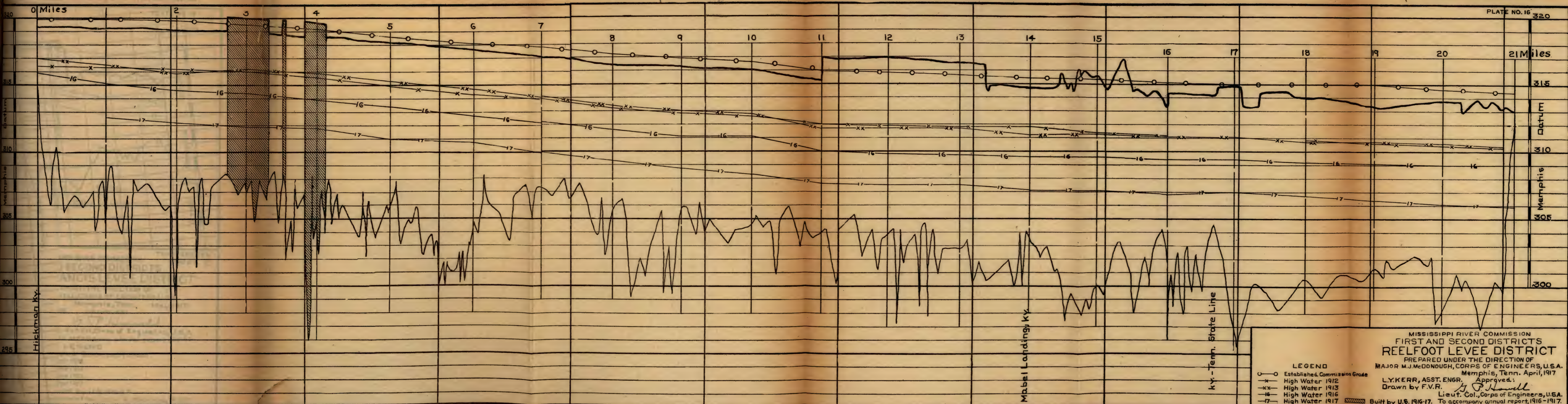












LEGEND  
 O Established Commission Grade  
 x High Water 1912  
 xx High Water 1913  
 16 High Water 1916  
 17 High Water 1917

MISSISSIPPI RIVER COMMISSION  
 FIRST AND SECOND DISTRICTS  
 REELFOOT LEVEE DISTRICT  
 PREPARED UNDER THE DIRECTION OF  
 MAJOR M.J. McDONOUGH, CORPS OF ENGINEERS, U.S.A.  
 Memphis, Tenn. April, 1917  
 L.Y. KERR, ASST. ENGR. Approved:  
 Drawn by F.V.R. *F.V.R.*  
 Lieut. Col., Corps of Engineers, U.S.A.  
 Built by U.S. 1916-17. To accompany annual report, 1916-1917.

175 Miles



1004

Memphis

210

$$\begin{array}{r} + \\ 2 \\ \hline 2 \\ 4 \end{array}$$

Rowley, Ark.

miles

TWO SHEETS  
SHEET 2

UNDER THE DIRECTION OF  
WELL, CORPS OF ENGINEERS, U.S.A.  
Memphis, Tenn. May, 1917.

Approved:

*B. P. Howell*  
Lieut. Col., Corps of Engineers, U. S. A.  
To accompany annual report 1916-'17

## LEGEND

ashed Commission Grade

ter 1912

ter 1913

her 1916

der 1917

ment by U.S. 1916-'17.

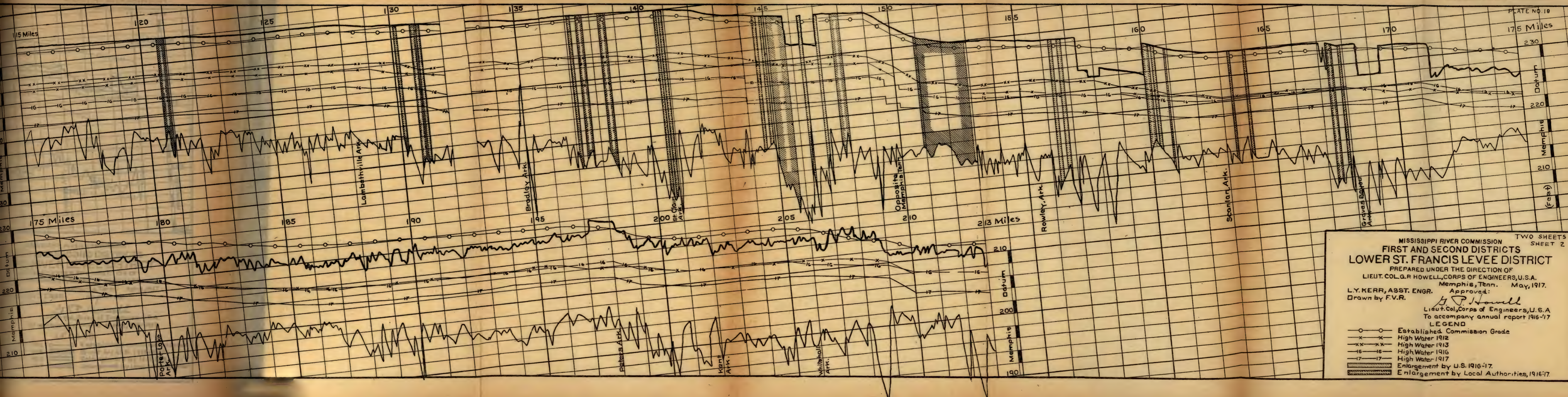
ement by Local Authorities, 1916-17.

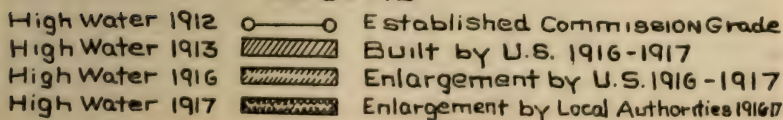
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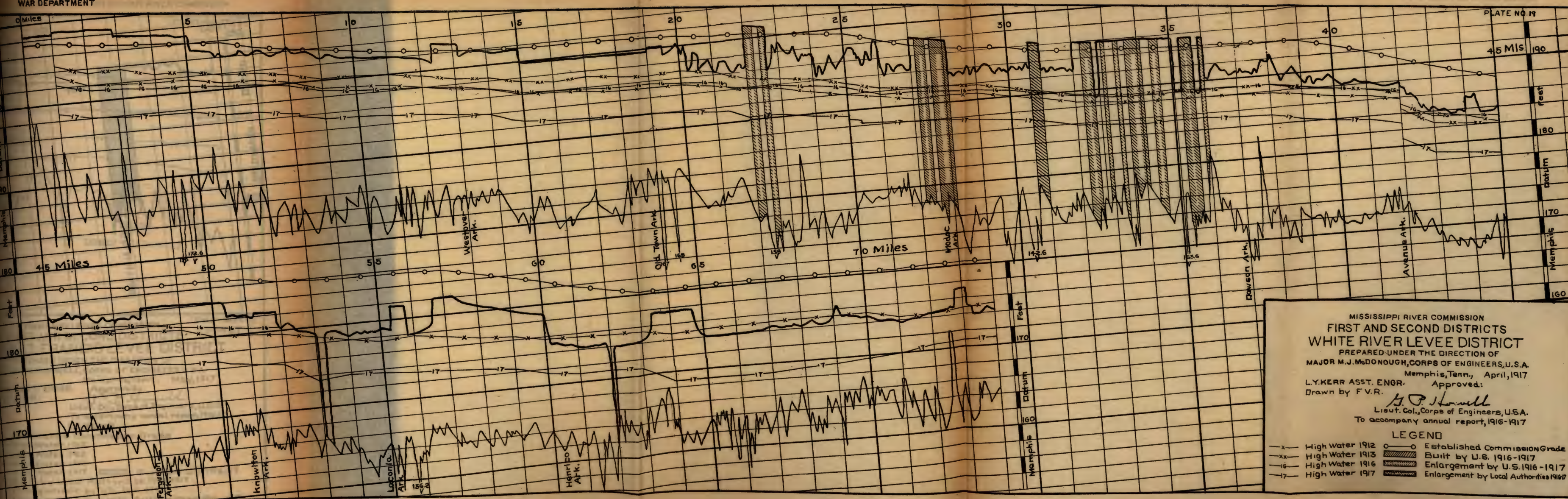
200

Memphis

190



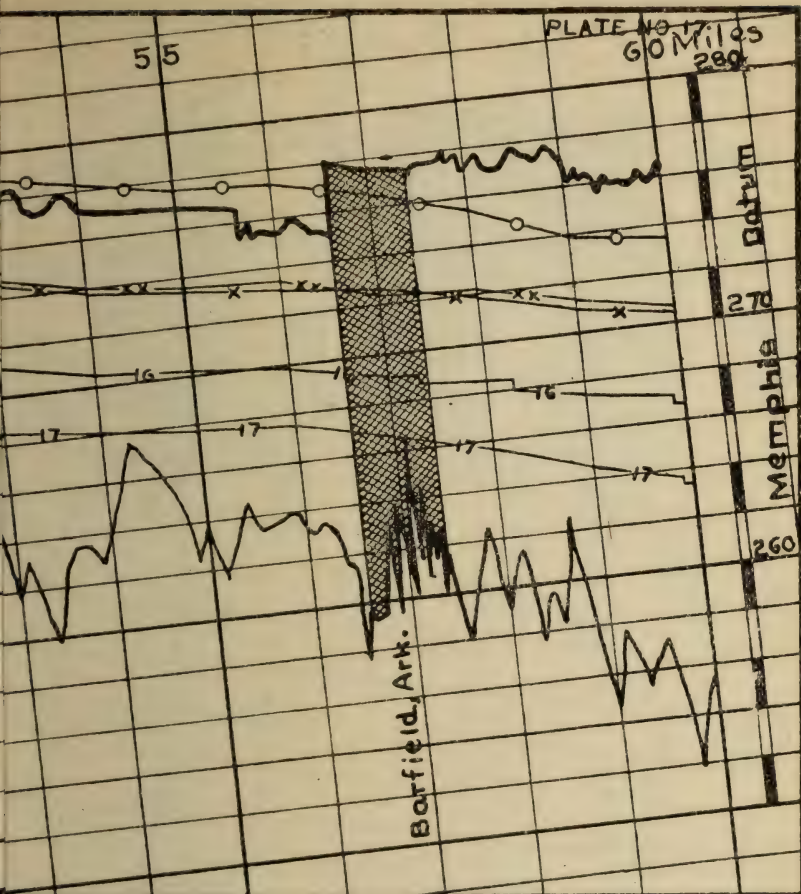




MISSISSIPPI RIVER COMMISSION  
**FIRST AND SECOND DISTRICTS**  
**WHITE RIVER LEVEE DISTRICT**  
 PREPARED UNDER THE DIRECTION OF  
 MAJOR M.J. McDONOUGH, CORPS OF ENGINEERS, U.S.A.  
 Memphis, Tenn., April, 1917  
 L.Y. KERR ASST. ENGR. Approved:  
 Drawn by F.V.R. *H.P. Howell*  
 Lieut. Col., Corps of Engineers, U.S.A.  
 To accompany annual report, 1916-1917

- LEGEND**
- x— High Water 1912
  - xx— High Water 1913
  - 16— High Water 1916
  - 17— High Water 1917
  - Established Commission Grade
  - [Vertical Hatching] Built by U.S. 1916-1917
  - [Horizontal Hatching] Enlargement by U.S. 1916-1917
  - [Wavy Line] Enlargement by Local Authorities 1917

# MISSISSIPPI RIVER COMMISSION



## MISSISSIPPI RIVER COMMISSION FIRST AND SECOND DISTRICTS ST. FRANCIS LEVEE DISTRICT

TWO SHEETS  
SHEET 1

PREPARED UNDER THE DIRECTION OF  
LT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.  
Memphis, Tenn. May, 1917

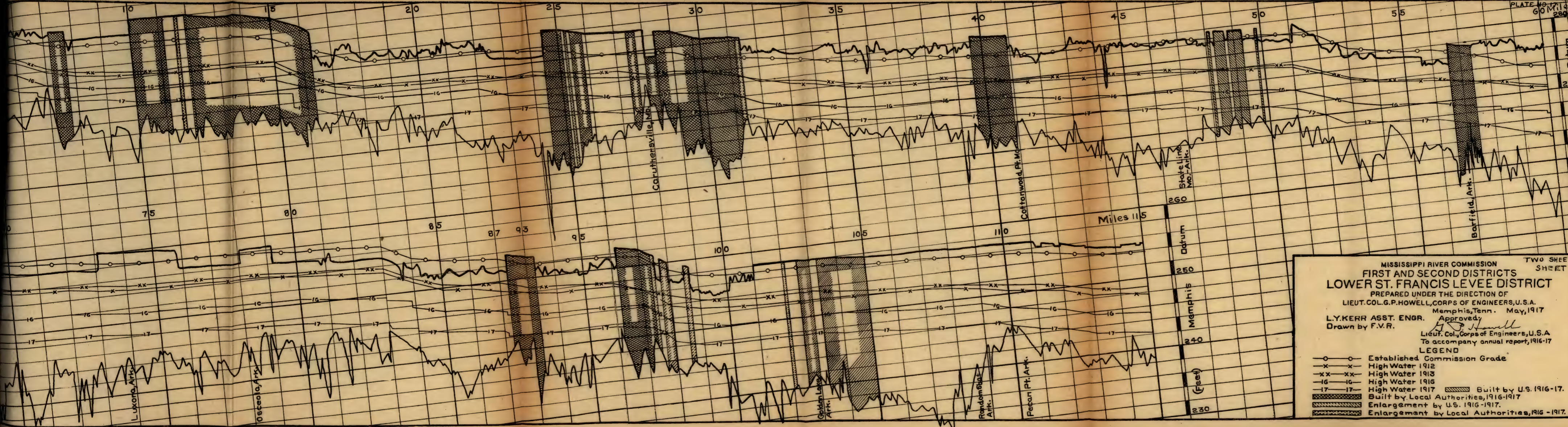
RR ASST. ENGR.  
by F.V.R.

Approved:

*G. P. Howell*  
Lieut. Col., Corps of Engineers, U.S.A.  
To accompany annual report, 1916-17

### LEGEND

- Established Commission Grade
- High Water 1912
- High Water 1913
- High Water 1916
- High Water 1917
- ▨ Built by U.S. 1916-17.
- ▨ Built by Local Authorities, 1916-1917
- ▨ Enlargement by U.S. 1916-1917.
- ▨ Enlargement by Local Authorities, 1916-1917.



MISSISSIPPI RIVER COMMISSION  
FIRST AND SECOND DISTRICTS  
**LOWER ST. FRANCIS LEVEE DISTRICT**  
PREPARED UNDER THE DIRECTION OF  
LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.  
Memphis, Tenn. May, 1917  
L. Y. KERR ASST. ENGR. Approved  
Drawn by F. V. R. *G. P. Howell*  
Lieut. Col., Corps of Engineers, U.S.A.  
To accompany annual report, 1916-17

**LEGEND**

|                      |                                |                         |                                              |
|----------------------|--------------------------------|-------------------------|----------------------------------------------|
| —o—o—                | Established Commission Grade   |                         |                                              |
| —x—x—                | High Water 1912                |                         |                                              |
| —xx—xx—              | High Water 1913                |                         |                                              |
| —16—16—              | High Water 1916                |                         |                                              |
| —17—17—              | High Water 1917                |                         |                                              |
| [Solid Black Box]    | Built by U.S. 1916-1917.       | [Diagonal Hatching Box] | Built by Local Authorities, 1916-1917        |
| [Cross-hatching Box] | Enlargement by U.S. 1916-1917. | [Diagonal Hatching Box] | Enlargement by Local Authorities, 1916-1917. |

TYPE SHEET  
SHEET 1

MISSISSIPPI RIVER COMMISSION  
FIRST AND SECOND DISTRICTS  
UPPER YAZOO LEVEL DISTRICT

PREPARED UNDER THE DIRECTION OF  
COL. O. R. HOWELL, CHIEF OF ENGINEERS, U.S.A.  
Memphis, Tenn. May, 1917

APPROVED:  
*[Signature]*  
Lieut. Col. Corps of Engineers, U.S.A.  
To accompany annual report DISTRICT

CHIEF, ARMY ENGINEER  
U.S.A.

Commissioner of Reclamation

U.S. DEPARTMENT OF AGRICULTURE  
BUREAU OF RECLAMATION

PLATE NO. 10

50

5.5 MILE

500

500

500

500

500

500

500

500

500

500



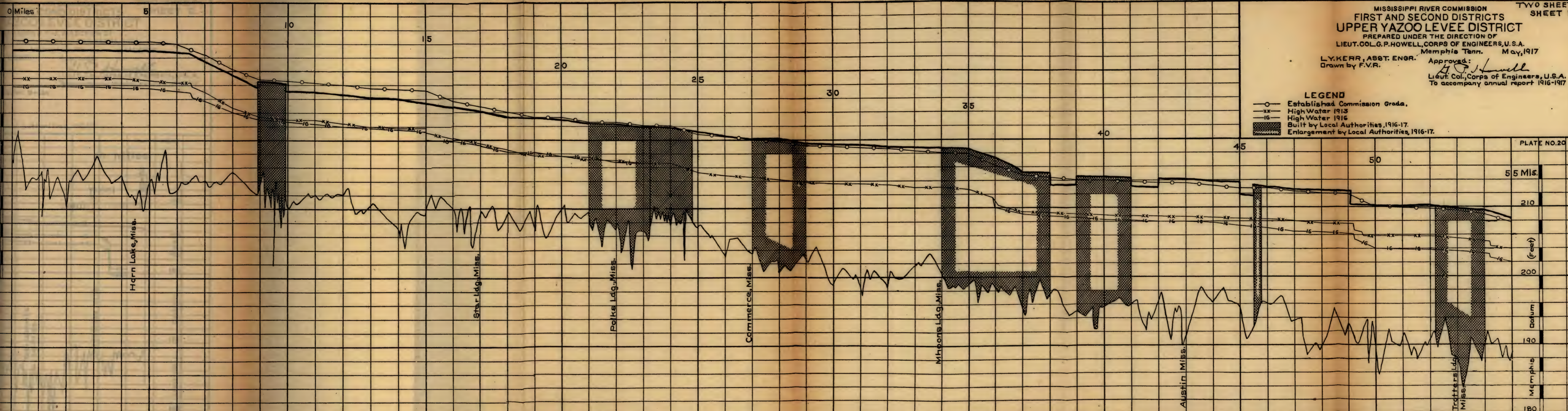
MISSISSIPPI RIVER COMMISSION  
FIRST AND SECOND DISTRICTS  
UPPER YAZOO LEVEE DISTRICT  
PREPARED UNDER THE DIRECTION OF  
LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.  
Memphis Tenn. May, 1917

L. Y. KERR, ASST. ENGR.  
Drawn by F. V. R.

Approved:  
*G. P. Howell*  
Lieut. Col., Corps of Engineers, U.S.A.  
To accompany annual report 1916-1917

LEGEND  
—○— Established Commission Grade.  
—xx— High Water 1913  
—16— High Water 1916  
[Hatched Box] Built by Local Authorities, 1916-17.  
[Dotted Box] Enlargement by Local Authorities, 1916-17.

PLATE NO. 20



MISSISSIPPI RIVER COMMISSION  
 AND SECOND DISTRICTS  
 AZOO LEVEE DISTRICT

TWO SHEETS  
 SHEET 2.

RED UNDER THE DIRECTION OF  
 HOWELL, CORPS OF ENGINEERS, U.S.A.

Memphis, Tenn.

MAY, 1917

ENGR.

Approved:

*G. O. Howell*

Lieut. Col., Corps of Engineers, U.S. A.

To accompany annual report, 1916-'17

ission Grade

Local Authorities, 1916-'17

PLATE NO. 21

20 Miles

21/35+72

190

(Feet)

180

Datum.

170

Memphis

160

Robinsonville  
 Ldg. Miss.

Malone Miss.

55 Miles

60

65

70

75

80 Miles

MISSISSIPPI RIVER COMMISSION  
 FIRST AND SECOND DISTRICTS  
 UPPER YAZOO LEVEE DISTRICT  
 PREPARED UNDER THE DIRECTION OF  
 LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U.S.A.  
 Memphis, Tenn. MAY, 1917  
 L. Y. KERR, ASST. ENGR.  
 Drawn by F. V. R.  
 Approved: *G. P. Howell*  
 Lieut. Col., Corps of Engineers, U.S.A.  
 To accompany annual report, 1916-17

LEGEND  
 ○ ○ Established Commission Grade  
 —xx—xx— High Water 1913  
 —16—16— High Water 1916  
 —17—17— High Water 1917  
 Enlargement by Local Authorities, 1916-17

210  
200  
190  
180  
170  
160

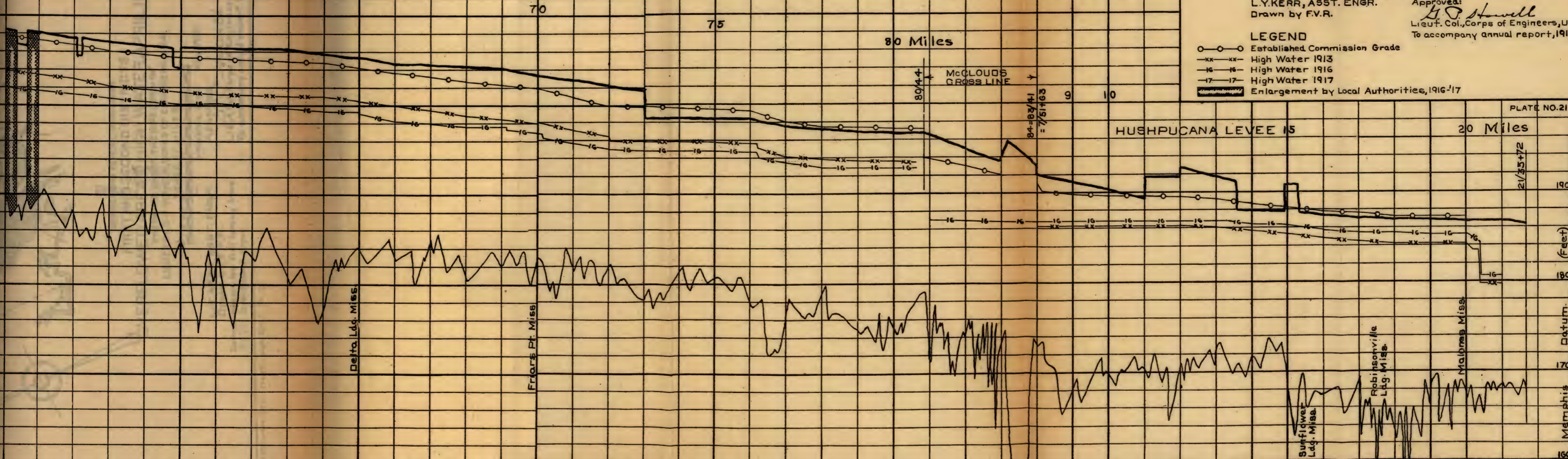


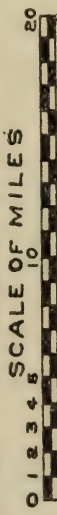
PLATE NO. 21

20 Miles

190  
180  
170  
160



MISSISSIPPI RIVER COMMISSION  
FIRST AND SECOND DISTRICTS  
OVERFLOWED AREAS, HIGH WATER, APRIL, 1917  
PREPARED UNDER THE DIRECTION OF  
LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U. S. A.



Memphis, Tenn. May, 1917.

L. Y. KERR ASST. ENGR.

Drawn by F. V. R.

Levees shown by full heavy lines  
Overflowed areas

Approved:-

*G. P. Howell*

Lieut. Col. Corps of Engineers, U. S. A.  
To accompany annual report 1916-1917.



MISSISSIPPI RIVER COMMISSION

MISSISSIPPI RIVER COMMISSION  
FIRST AND SECOND DISTRICTS

FIRST AND SECOND DISTRICTS  
LOWED AREAS, HIGH WATER, APPROXIMATE  
PREPARED UNDER THE DIRECTION OF  
LIEUT. COL. G. P. HOWELL, CORPS OF ENGINEERS, U. S. A.

0 1 2 3 4 5 SC/

Memphis, Tenn. May, 1917

*Abstract of contracts in force June 30, 1917—Continued.*

| Names of contractors.                     | Amount and character of work.                             | Rate per cubic yard. | Date of approval. | Date of beginning work. | Date of expiration of contract. |
|-------------------------------------------|-----------------------------------------------------------|----------------------|-------------------|-------------------------|---------------------------------|
|                                           |                                                           | <i>Cents.</i>        | 1915.             | 1916.                   | 1917.                           |
| by Construction Co.—<br>tinued.           | 102,000 cubic yards levee work,<br>stations 70/26-71-0.   | 11.00                | Sept. 10          | Feb. 10                 | Dec. 31                         |
| o.....                                    | 200,000 cubic yards levee work,<br>stations 71/0-72/0.    | 10.00                | ...do.....        | ...do.....              | Do.                             |
| o.....                                    | 158,000 cubic yards levee work,<br>stations 72/0-72/26.   | 16.56                | ...do.....        | ...do.....              | Do.                             |
| o.....                                    | 843,000 cubic yards levee work,<br>stations 72/26-76/0.   | 9.00                 | ...do.....        | ...do.....              | Do.                             |
| <i>Reelfoot levee district.</i>           |                                                           |                      |                   |                         |                                 |
| h, Stansell, Lowrance<br>s. & Co.         | 360,000 cubic yards levee work,<br>stations 2/37-4/36.    | 16.00                | 1916.<br>Nov. 4   | Nov. 21                 | Do.                             |
| <i>St. Francis levee district.</i>        |                                                           |                      |                   |                         |                                 |
| ers Bros.....                             | 400,000 cubic yards levee work,<br>stations 48/4-49/49.   | 18.50                | Oct. 11           | Oct. 27                 | Do.                             |
| Leonard.....                              | 200,000 cubic yards levee work,<br>stations 97/20-101/0.  | 26.00                | Oct. 9            | Oct. 24                 | Do.                             |
| & Reagan.....                             | 440,000 cubic yards levee work,<br>stations 145/6-146/15. | 21.80                | 1915.<br>July 8   | 1915.<br>July 25        | 1916.<br>Dec. 31                |
| h, Stansell, Lowrance<br>s. & Co.         | 227,896 cubic yards levee work,<br>stations 146/15-147/8. | 17.50                | July 14           | July 24                 | 1, 2 Do.                        |
| Leonard.....                              | 277,000 cubic yards levee work,<br>stations 157/19-160/0. | 26.00                | 1916.<br>Oct. 9   | 1916.<br>Oct. 24        | 1917.<br>Dec. 31                |
| <i>White River levee district.</i>        |                                                           |                      |                   |                         |                                 |
| ers Bros.....                             | 250,000 cubic yards levee work,<br>stations 30/28-31/18.  | 21.30                | Oct. 21           | Nov. 7                  | Dec. 31                         |
| o.....                                    | 284,000 cubic yards levee work,<br>stations 32/0-34/0.    | 18.20                | 1915.<br>July 14  | 1915.<br>July 27        | 1916.<br>Dec. 31                |
| o.....                                    | 300,000 cubic yards levee work,<br>stations 34/0-36/0.    | 18.20                | ...do.....        | ...do.....              | 1, 2 Do.                        |
| o.....                                    | 150,000 cubic yards levee work,<br>stations 36/0-37/0.    | 29.70                | 1916.<br>Oct. 21  | 1916.<br>Nov. 8         | 1917.<br>Dec. 31                |
| <i>Leases, stone, etc.</i>                |                                                           |                      |                   |                         |                                 |
| f. Fisher.....                            | Rent of river front at Memphis,<br>Tenn.                  | <sup>3</sup> \$50    | Lease.            | July 1                  | 1917.<br>June 30                |
| es H. Boyle.....                          | do.....                                                   | <sup>3</sup> 50.00   | ...do.....        | ...do.....              | Do.                             |
| Jennie Astor and hus-<br>nd, W. B. Astor. | Rent of land near Government<br>fleet.                    | <sup>3</sup> 100.00  | ...do.....        | ...do.....              | Do.                             |
| ouis-San Francisco Ry.                    | do.....                                                   | <sup>3</sup> 125.00  | ...do.....        | ...do.....              | Do.                             |
| essee Contracting Co.....                 | Furnishing brush and poles,<br>100,000 cords.             | <sup>4</sup> 1.75    | 1916.<br>Oct. 11  | Oct. 17                 | ( <sup>7</sup> )                |
| ld Stone Co.....                          | Furnishing 12,000 cubic yards rip-<br>rap stone.          | <sup>5</sup> 1.00    | 1917.<br>Mar. 30  | 1917.<br>Apr. 26        | 1917.<br>Aug. 23                |
| d & Brown.....                            | Furnishing 25,000 tons riprap<br>stone.                   | <sup>6</sup> .49     | Apr. 19           | May 10                  | July 31                         |

<sup>1</sup> Work temporarily suspended.<sup>2</sup> Time limit waived.<sup>3</sup> Per annum.<sup>4</sup> Per cord.<sup>5</sup> Per cubic yard.<sup>6</sup> Per ton.<sup>7</sup> Indefinite.

## FINANCIAL STATEMENT, FIRST AND SECOND MISSISSIPPI RIVER DISTRICTS.

*Appropriation for Mississippi River.*

## SURVEYS.

|                                                                            |              |
|----------------------------------------------------------------------------|--------------|
| Amount allotted from river and harbor act, July 27, 1916.....              | \$5, 000. 00 |
| Amount received from sale of United States property (contact prints) ..... | 4. 32        |
|                                                                            | <hr/>        |
| June 30, 1917, amount expended during fiscal year.....                     | 5, 004. 32   |
|                                                                            | <hr/>        |

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Amount allotted from river and harbor act, July 27, 1916..... | 100, 000. 00 |
| July 1, 1917, balance unexpended.....                         | 100, 000. 00 |
| July 1, 1917, outstanding liabilities.....                    | \$1, 000. 00 |
| July 1, 1917, amount covered by uncompleted contracts.....    | 95, 500. 00  |
|                                                               | <hr/>        |
|                                                               | 96, 500. 00  |
|                                                               | <hr/>        |
| July 1, 1917, balance available.....                          | 3, 500. 00   |

## LOWER ST. FRANCIS LEVEE DISTRICT.

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Amount allotted from river and harbor act, July 27, 1916..... | 270, 000. 00 |
| June 30, 1917, amount expended during fiscal year.....        | 35, 367. 48  |
|                                                               | <hr/>        |
| July 1, 1917, balance unexpended.....                         | 234, 632. 52 |
| July 1, 1917, outstanding liabilities.....                    | \$1, 200. 00 |
| July 1, 1917, amount covered by uncompleted contracts.....    | 189, 200. 00 |
|                                                               | <hr/>        |
|                                                               | 190, 400. 00 |
|                                                               | <hr/>        |
| July 1, 1917, balance available.....                          | 44, 232. 52  |

## WHITE RIVER LEVEE DISTRICT.

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Amount allotted from river and harbor act, July 27, 1916..... | 100, 000. 00 |
| July 1, 1917, balance unexpended.....                         | 100, 000. 00 |
| July 1, 1917, outstanding liabilities.....                    | \$600. 00    |
| July 1, 1917, amount covered by uncompleted contracts.....    | 79, 400. 00  |
|                                                               | <hr/>        |
|                                                               | 80, 000. 00  |
|                                                               | <hr/>        |
| July 1, 1917, balance available.....                          | 20, 000. 00  |

## REELFOOT LEVEE DISTRICT.

|                                                               |             |
|---------------------------------------------------------------|-------------|
| Amount allotted from river and harbor act, July 27, 1916..... | 40, 000. 00 |
| June 30, 1917, amount expended during fiscal year.....        | 8, 029. 66  |
|                                                               | <hr/>       |
| July 1, 1917, balance unexpended.....                         | 31, 970. 34 |
| July 1, 1917, outstanding liabilities.....                    | \$200. 00   |
| July 1, 1917, amount covered by uncompleted contracts.....    | 22, 000. 00 |
|                                                               | <hr/>       |
|                                                               | 22, 200. 00 |
|                                                               | <hr/>       |
| July 1, 1917, balance available.....                          | 9, 770. 34  |

## GAYOSO BEND, MO.

|                                                               |               |
|---------------------------------------------------------------|---------------|
| Amount allotted from river and harbor act, July 27, 1916..... | 150, 000. 00  |
| June 30, 1917, amount expended during fiscal year.....        | 56, 778. 56   |
|                                                               | <hr/>         |
| July 1, 1917, balance unexpended.....                         | 93, 221. 44   |
| July 1, 1917, outstanding liabilities.....                    | \$20, 500. 00 |
| July 1, 1917, amount covered by uncompleted contracts.....    | 31, 900. 00   |
|                                                               | <hr/>         |
|                                                               | 52, 400. 00   |
|                                                               | <hr/>         |
| July 1, 1917, balance available.....                          | 40, 821. 44   |

## BARFIELD, ARK.

|                                                          |              |
|----------------------------------------------------------|--------------|
| Amount allotted from river and harbor act, July 27, 1916 | \$200,000.00 |
| June 30, 1917, amount expended during fiscal year        | 149,730.03   |
| July 1, 1917, balance unexpended                         | 50,269.97    |
| July 1, 1917, outstanding liabilities                    | \$10,500.00  |
| July 1, 1917, amount covered by uncompleted contracts    | 20,500.00    |
|                                                          | 31,000.00    |
| July 1, 1917, balance available                          | 19,269.97    |

## BULLERTON BAR, ARK.

|                                                          |            |
|----------------------------------------------------------|------------|
| Amount allotted from river and harbor act, July 27, 1916 | 150,000.00 |
| June 30, 1917, amount expended during fiscal year        | 65,242.68  |
| July 1, 1917, balance unexpended                         | 84,757.32  |
| July 1, 1917, outstanding liabilities                    | \$1,800.00 |
| July 1, 1917, amount covered by uncompleted contracts    | 2,000.00   |
|                                                          | 3,800.00   |
| July 1, 1917, balance available                          | 80,957.32  |

## WOLF RIVER.

|                                                   |        |
|---------------------------------------------------|--------|
| July 1, 1916, balance unexpended                  | 192.79 |
| June 30, 1917, amount expended during fiscal year | 192.79 |

## MEMPHIS HARBOR.

|                                                          |           |
|----------------------------------------------------------|-----------|
| Amount allotted from river and harbor act, July 27, 1916 | 26,000.00 |
| June 30, 1917, amount expended during fiscal year        | 21,107.77 |
| July 1, 1917, balance unexpended                         | 4,892.23  |
| July 1, 1917, outstanding liabilities                    | 4,892.23  |

## PORTER LAKE, ARK.

|                                                          |            |
|----------------------------------------------------------|------------|
| Amount allotted from river and harbor act, July 27, 1916 | 105,000.00 |
| June 30, 1917, amount expended during fiscal year        | 34,453.66  |
| July 1, 1917, balance unexpended                         | 70,546.34  |
| July 1, 1917, outstanding liabilities                    | \$9,800.00 |
| July 1, 1917, amount covered by uncompleted contracts    | 37,800.00  |
|                                                          | 47,600.00  |
| July 1, 1917, balance available                          | 22,946.34  |

## HELENA, ARK.

|                                                   |           |
|---------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                  | 31,320.75 |
| June 30, 1917, amount expended during fiscal year | 1,150.33  |
| July 1, 1917, balance unexpended and available    | 30,170.42 |

## OLD TOWN BEND, ARK.

|                                                          |            |
|----------------------------------------------------------|------------|
| Amount allotted from river and harbor act, July 27, 1916 | 105,000.00 |
| June 30, 1917, amount expended during fiscal year        | 78,177.68  |
| July 1, 1917, balance unexpended                         | 26,822.32  |
| July 1, 1917, outstanding liabilities                    | \$9,400.00 |
| July 1, 1917, amount covered by uncompleted contracts    | 14,400.00  |
|                                                          | 23,800.00  |
| July 1, 1917, balance available                          | 3,022.32   |

## 3550 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

## GENERAL REPAIRS AND STONE.

|                                                                                  |             |
|----------------------------------------------------------------------------------|-------------|
| Amount allotted from river and harbor act, July 27, 1916                         | \$50,000.00 |
| June 30, 1917, amount expended during fiscal year for account works, as follows: |             |
| Star Landing, Miss                                                               | \$609.26    |
| Stone                                                                            | 3,419.24    |
|                                                                                  | 4,028.50    |
| July 1, 1917, balance unexpended                                                 | 45,971.50   |
| July 1, 1917, outstanding liabilities                                            | \$2,100.00  |
| July 1, 1917, amount covered by uncompleted contracts                            | 21,350.00   |
|                                                                                  | 23,450.00   |
| July 1, 1917, balance available                                                  | 22,521.50   |

## PLANT.

|                                                               |           |
|---------------------------------------------------------------|-----------|
| Amount allotted from river and harbor act, July 27, 1916      | 75,000.00 |
| Amount received from sale of condemned United States property | 380.00    |
|                                                               | 75,380.00 |
| June 30, 1917, amount expended during fiscal year             | 49,036.00 |
| July 1, 1917, balance unexpended                              | 26,344.00 |
| July 1, 1917, outstanding liabilities                         | 5,600.00  |
| July 1, 1917, balance available                               | 20,744.00 |

## NEW PLANT.

|                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------|------------|
| July 1, 1916, balance unexpended                                                                           | 2,133.00   |
| Amount allotted from river and harbor act, July 27, 1916                                                   | 297,000.00 |
|                                                                                                            | 299,133.00 |
| June 30, 1917, amount expended during fiscal year                                                          | 117,341.00 |
| July 1, 1917, balance unexpended                                                                           | 181,791.00 |
| July 1, 1917, outstanding liabilities                                                                      | 46,000.00  |
| July 1, 1917, balance available                                                                            | 135,791.00 |
| <i>Appropriation for maintenance and improvement of existing river and harbor works, act Oct. 2, 1914.</i> |            |

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                   |            |
|---------------------------------------------------|------------|
| July 1, 1916, balance unexpended                  | \$1,485.00 |
| June 30, 1917, amount expended during fiscal year | 1,485.00   |

## WATSON POINT DIKE, AT SLOUGH LANDING NECK.

|                                                   |        |
|---------------------------------------------------|--------|
| July 1, 1916, balance unexpended                  | 473.00 |
| June 30, 1917, amount expended during fiscal year | 30.00  |
| July 1, 1917, balance unexpended and available    | 442.00 |

## STAR LANDING, MISS.

|                                                   |           |
|---------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                  | 20,125.00 |
| June 30, 1917, amount expended during fiscal year | 20,125.00 |

## GENERAL REPAIRS AND STONE.

|                                                                                  |            |
|----------------------------------------------------------------------------------|------------|
| July 1, 1916, balance unexpended                                                 | 10,610.00  |
| June 30, 1917, amount expended during fiscal year for account works, as follows: |            |
| Star Landing, Miss                                                               | \$1,724.54 |
| Trotters Point, Miss                                                             | 2.23       |
| Sunflower, Miss                                                                  | 8.05       |
| Plant (repairs)                                                                  | 8,875.19   |
|                                                                                  | 10,610.00  |

*appropriation for maintenance and improvement of existing river and harbor works, act Mar. 4, 1915.*

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                       |                          |
|-------------------------------------------------------|--------------------------|
| July 1, 1916, balance unexpended                      | <sup>1</sup> \$50,674.86 |
| June 30, 1917, amount expended during fiscal year     | 27,664.35                |
| July 1, 1917, balance unexpended                      | 23,010.51                |
| July 1, 1917, amount covered by uncompleted contracts | 23,010.51                |

## LOWER ST. FRANCIS LEVEE DISTRICT.

|                                                   |                         |
|---------------------------------------------------|-------------------------|
| July 1, 1916, balance unexpended                  | <sup>2</sup> 162,333.55 |
| June 30, 1917, amount expended during fiscal year | 162,333.55              |

## WHITE RIVER LEVEE DISTRICT.

|                                                                       |                         |
|-----------------------------------------------------------------------|-------------------------|
| July 1, 1916, balance unexpended                                      | <sup>3</sup> 133,809.49 |
| Amount received from sale of United States property (contract prints) | .45                     |
| June 30, 1917, amount expended during fiscal year                     | 133,809.94              |
| July 1, 1917, balance unexpended                                      | 110,567.73              |
| July 1, 1917, amount covered by uncompleted contracts                 | 23,242.21               |
| July 1, 1917, amount covered by uncompleted contracts                 | 23,242.21               |

## SLOUGH LANDING NECK, TENN.

|                                                   |           |
|---------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                  | 41,790.20 |
| June 30, 1917, amount expended during fiscal year | 33,031.95 |
| July 1, 1917, balance unexpended                  | 8,758.25  |
| July 1, 1917, outstanding liabilities             | 200.00    |
| July 1, 1917, balance available                   | 8,558.25  |

## PLUM POINT REACH.

|                                                   |           |
|---------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                  | 55,521.81 |
| June 30, 1917, amount expended during fiscal year | 55,521.81 |

## MEMPHIS HARBOR.

|                                              |           |
|----------------------------------------------|-----------|
| Amount received by transfer from Delta, Miss | 25,000.00 |
| July 1, 1917, balance unexpended             | 25,000.00 |
| July 1, 1917, outstanding liabilities        | 6,500.00  |
| July 1, 1917, balance available              | 18,500.00 |

<sup>1</sup> Balance reported as unexpended at end of last fiscal year, viz, \$50,254.86, increased \$420, due to reimbursement received in July, 1916, from Little River drainage district, Cape Girardeau, Mo., for inspection expenses incurred and disbursed for account of district prior to July 1, 1916.

<sup>2</sup> Balance reported as unexpended at end of last fiscal year, viz, \$162,333.35, increased 0 cents, due to refundment of overpayment on voucher in accounts in fiscal year 1916.

<sup>3</sup> Balance reported as unexpended at end of last fiscal year, viz, \$133,809.04, increased 5 cents, due to refundment of overpayment on voucher in accounts in fiscal year 1916.

## DELTA, MISS.

|                                                |              |
|------------------------------------------------|--------------|
| July 1, 1916, balance unexpended               | \$133,445.00 |
| Less transfers during fiscal year, as follows: |              |
| To new plant                                   | \$15,000.00  |
| To Memphis Harbor                              | 25,000.00    |
|                                                | 40,000.00    |

|                                                   |           |
|---------------------------------------------------|-----------|
| June 30, 1917, amount expended during fiscal year | 93,445.00 |
|                                                   | 83,035.00 |
| July 1, 1917, balance unexpended                  | 10,409.80 |
| July 1, 1917, outstanding liabilities             | 200.00    |
| July 1, 1917, balance available                   | 10,209.80 |

## GENERAL REPAIRS AND STONE.

|                                                                                  |           |
|----------------------------------------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                                                 | 50,000.00 |
| June 30, 1917, amount expended during fiscal year for account works, as follows: |           |
| Slough Landing Neck, Tenn                                                        | \$535.30  |
| Barfield, Ark                                                                    | 1,545.98  |
| Plum Point Reach                                                                 | 20,041.39 |
| Hopefield Bend, Ark                                                              | 7,296.03  |
| Star Landing, Miss                                                               | 8,855.62  |
| Sunflower, Miss                                                                  | 172.50    |
| Plant (repairs)                                                                  | 9,979.81  |
| Stone                                                                            | 1,573.37  |
|                                                                                  | 50,000.00 |

## EXPERIMENTAL REVETMENT.

|                                                   |          |
|---------------------------------------------------|----------|
| July 1, 1916, balance unexpended                  | 2,986.50 |
| June 30, 1917, amount expended during fiscal year | 156.80   |
| July 1, 1917, balance unexpended                  | 2,829.70 |
| July 1, 1917, outstanding liabilities             | 2,829.70 |

## PLANT.

|                                                   |          |
|---------------------------------------------------|----------|
| July 1, 1916, balance unexpended                  | 8,940.00 |
| June 30, 1917, amount expended during fiscal year | 8,940.00 |

## NEW PLANT.

|                                                   |           |
|---------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                  | 14,025.30 |
| Amount received by transfer from Delta, Miss      | 15,000.00 |
|                                                   | 29,025.30 |
| June 30, 1917, amount expended during fiscal year | 14,025.30 |
| July 1, 1917, balance unexpended                  | 15,000.00 |
| July 1, 1917, outstanding liabilities             | 15,000.00 |

<sup>1</sup> Balance reported as unexpended at end of last fiscal year, viz, \$133,445.19, increased 40 cents, due to refundment of overpayments on vouchers in accounts in fiscal year 1917.

<sup>2</sup> Balance reported as unexpended at end of fiscal year, viz, \$8,927.08, increased \$13.92, due to causes as follows:

|                                                                                                                                  |         |
|----------------------------------------------------------------------------------------------------------------------------------|---------|
| Reimbursement from appropriation for Panama Canal for inspection expenses incurred and paid for Panama Canal in fiscal year 1916 | \$13.92 |
| Refundment of overpayment on voucher in accounts in fiscal year 1916                                                             |         |

*Funds contributed for improvement of Mississippi River in Upper St. Francis levee district.*

## SPECIAL FUNDS.

|                                                                                                                                                                          |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| July 1, 1916, balance unexpended (contributed for expenditure in the Upper St. Francis levee district by the St. Johns levee and drainage district, New Madrid, Mo)----- | \$200,000.00     |
| Amount contributed for expenditure in the Upper St. Francis levee district by the Mississippi County Levee Board No. 1, of Missouri, Charleston, Mo-----                 | 34,000.00        |
|                                                                                                                                                                          | <hr/> 234,000.00 |
| June 30, 1917, amount expended during fiscal year-----                                                                                                                   | 26,734.69        |

|                                                            |            |
|------------------------------------------------------------|------------|
| July 1, 1917, balance unexpended-----                      | 207,265.31 |
| July 1, 1917, amount covered by uncompleted contracts----- | 207,265.31 |

*Funds contributed for improvement of Mississippi River in the Reelfoot levee district, Kentucky.*

## SPECIAL FUND.

|                                                                                       |             |
|---------------------------------------------------------------------------------------|-------------|
| Amount contributed for expenditure by the Fulton County Levee Board, Hickman, Ky----- | \$25,000.00 |
| June 30, 1917, amount expended during fiscal year-----                                | 25,000.00   |

*Funds contributed for improvement of Mississippi River at Gayoso Bend, Mo.*

## SPECIAL FUND.

|                                                                                                        |              |
|--------------------------------------------------------------------------------------------------------|--------------|
| Amount contributed for expenditure by the St. Francis Levee Board of Missouri, Caruthersville, Mo----- | \$150,000.00 |
| June 30, 1917, amount expended during fiscal year-----                                                 | 150,000.00   |

## APPENDIX 3.

## IMPROVING MISSISSIPPI RIVER, THIRD DISTRICT.

This district extends from White River, Ark., to Warrenton, Miss., a distance of 214 miles by river.

District headquarters: Vicksburg, Miss.

District officer: Maj. J. R. Slattery, Corps of Engineers.

## WORKS.

## I. Channel work:

- (a) Lake Bolivar Front, Miss.
- (b) Ashbrook Neck, Miss.
- (c) Panther Forest, Ark.
- (d) Leland Neck, Ark.
- (e) Greenville, Miss.
- (f) Vacluse, Ark.
- (g) Longwood, Miss.
- (h) Grand Lake, Ark.
- (i) Lake Providence Reach.
- (j) Fitlers Bend, Miss.
- (k) Cottonwood, Miss.
- (l) Albemarle Bend, Miss.
- (m) Delta Point, La.
- (n) Mouth of Yazoo River and Harbor of Vicksburg, Miss.
- (o) Vicksburg revetment.
- (p) Reid-Bedford Bend, La.
- (q) Cummins, Ark.
- (r) Red Fork, Ark.

## II. Levees:

- (a) Upper Tensas levee district.
- (b) Lower Yazoo levee district.

## III. Surveys:

- (a) Revetment.
- (b) Reach and bank line.

## IV. Plant.

## V. High-water work

## I. CHANNEL WORK.

(a) *Lake Bolivar Front, Miss.*

*Location.*—Four hundred and seventeen miles below Cairo, left bank.

*Original condition.*—Caving appears to have become active on this point about 1887, and by the latter part of 1888 it became evident that unless the bank was revetted the levee across the head of Lake Bolivar would be destroyed. The destruction of this levee would have necessitated building a long and expensive loop back of the lake.

*Previous projects.*—None.

*Present project.*—The present project was adopted by the river and harbor act approved August 11, 1888, and provides for a revetment to correct, permanently locate, and deepen the channel of the river and to protect its bank against caving, and thus save a levee situated between the head of Lake Bolivar and the river the destruction of which would have resulted in the abandonment of a large area of valuable land and would have necessitated the construction of a long and expensive loop back of Lake Bolivar.

*Operations and results prior to the present year.*—Work was commenced November 1, 1888, and by the latter part of January, 1889, 4,250 feet of bank was revetted with woven willow subaqueous mats and brush and riprap upper-bank pavement. From 1889 to 1906 only minor repairs were made to this work, but by this time the original mats had failed to such an extent that 2,134 feet of fascine mat work was placed, replacing woven mats that had failed and extending the revetment 205 feet downstream. During 1907, 1908, 1909, and 1910 the balance of the original woven mats failed and were replaced with fascine mats. In 1912 the revetment was extended 2,000 feet downstream by subaqueous fascine mats and riprap upper-bank paving. In 1913, 1914, and 1915 only minor repairs were necessary. In 1915–16 the revetment was extended 1,940 feet downstream, and minor repairs were made. As a result of this work the bank at this point has been successfully held, and the necessity of building a new levee avoided. The expenditures prior to the present year have been \$264,640.3 for original work and extensions and \$179,576.12 for repairs and renewals, a total of \$444,216.43.

*Operations and results during the present year.*—Work on a downstream extension was commenced August 7, 1916, and continued as long as labor could be obtained. One channel mat and four connecting mats, with an aggregate area of 3,161 squares, and length of 1,100 feet, and 760 squares of concrete and 37 squares of stone paving were laid, thus extending the revetment 1,050 feet downstream. The location of the work is shown on plate 3 accompanying. The total expenditures (not including prorated amount of cost of care, depreciation, and maintenance of plant) were \$36,693.75, of which amount \$31,581.69 was for new work and \$5,112.06 for maintenance. Detailed cost data is given in the following table:

## LAKE BOLIVAR REVETMENT (417 L.), THIRD DISTRICT.

Mattresses, total area 3,161 squares (channel, 85 per cent; connecting, 15 per cent).<sup>1</sup>

## BUILDING MATERIAL.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$111.09    |             | \$0.035 |
| 1-inch strand <sup>3</sup> .....pounds             | 20,201          | 1,454.47    | 6.39        | .460    |
| 1/2-inch strand <sup>3</sup> .....do               | 11,296          | 646.03      | 3.57        | .204    |
| 3/4-inch strand <sup>3</sup> .....do               | 32,821          | 2,067.73    | 10.38       | .654    |
| Spikes <sup>3</sup> .....do                        | 709             | 217.00      | .22         | .069    |
| Staples <sup>3</sup> .....do                       | 800             | 29.60       | .25         | .009    |
| Clips, 1/2-inch <sup>3</sup> .....number           | 130             | 12.35       | .04         | .004    |
| Clips, 3/4-inch <sup>3</sup> .....do               | 130             | 14.30       | .04         | .005    |
| Brush and poles <sup>3</sup> .....cords            | 4,972           | 5,631.18    | 1.57        | 1.750   |
| Rope, manila <sup>3</sup> .....pounds              | 3,684           | 660.12      | 1.17        | .218    |
| Coal <sup>4</sup> .....tons                        | 2.4             | 7.20        |             | .002    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 581.78      |             | .184    |
| Subsistence <sup>6</sup> .....                     |                 | 1,288.00    |             | .407    |
| Steamboat expenses <sup>7</sup> .....              |                 | 206.95      |             | .065    |
| Labor <sup>8</sup> .....                           |                 | 2,642.43    |             | .836    |
| Supervision <sup>9</sup> .....                     |                 | 616.16      |             | .195    |
| Total.....                                         |                 | 16,186.39   |             | 5.097   |

## BALLASTING AND SINKING.

|                                           |       |            |      |         |
|-------------------------------------------|-------|------------|------|---------|
| Stone <sup>3</sup> .....tons              | 2,506 | \$5,017.76 | 0.79 | \$1.587 |
| Rope, manila <sup>3</sup> .....pounds     | 3,684 | 660.12     | 1.17 | .209    |
| Miscellaneous expenses <sup>5</sup> ..... |       | 290.89     |      | .092    |
| Subsistence <sup>6</sup> .....            |       | 287.50     |      | .091    |
| Labor <sup>8</sup> .....                  |       | 631.12     |      | .200    |
| Supervision <sup>9</sup> .....            |       | 121.25     |      | .038    |
| Total.....                                |       | 7,008.64   |      | 2.217   |

## Grading.

|                                       | Quantity used.  |             | Per square. |         |
|---------------------------------------|-----------------|-------------|-------------|---------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>4</sup> .....tons           |                 | \$196.02    |             | \$0.173 |
| Oil <sup>4</sup> .....                |                 | 25.00       |             | .022    |
| Subsistence <sup>6</sup> .....        |                 | 173.00      |             | .152    |
| Steamboat expenses <sup>7</sup> ..... |                 | 107.55      |             | .090    |
| Labor <sup>8</sup> .....              |                 | 620.32      |             | .546    |
| Total.....                            |                 | 1,121.89    |             | .983    |

See page 3556 for footnotes.

*Paving.*

|                                           | Quantity used.    |             | Per square. |         |
|-------------------------------------------|-------------------|-------------|-------------|---------|
|                                           | Total quantity.   | Total cost. | Quantity.   | Cost.   |
| Stone <sup>3</sup> .....                  | tons.. 1,959      | \$3,922.11  | 5.25        | \$10.46 |
| Cement <sup>3</sup> .....                 | sacks.. 3,114     | 1,269.69    | 4.10        | 1.67    |
| Sand and gravel <sup>3</sup> .....        | cubic yards.. 960 | 759.65      | 1.26        | 1.00    |
| Coal <sup>4</sup> .....                   | tons.. 169        | 507.96      | .15         | .44     |
| Miscellaneous expenses <sup>5</sup> ..... |                   | 290.89      |             | .25     |
| Subsistence <sup>6</sup> .....            |                   | 1,089.10    |             | .96     |
| Steamboat expenses <sup>7</sup> .....     |                   | 206.95      |             | .18     |
| Labor <sup>8</sup> .....                  |                   | 2,039.21    |             | 1.80    |
| Supervision <sup>9</sup> .....            |                   | 494.91      |             | .43     |
| Total.....                                |                   | 10,580.47   |             | 17.21   |
| Total field cost <sup>10</sup> .....      |                   | *34,897.39  |             |         |

\*Includes repairs amounting to \$5,112.06.

*Summary of costs (linear feet revetted, 1,050).*

|                                           | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                           | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....                     | \$7.34           | \$23,195.03 | \$10.31          | \$11,702.36 | \$34,897.39  | \$30.00                     |
| Office expenses.....                      |                  |             |                  |             | 1,599.36     |                             |
| Surveys <sup>11</sup> .....               |                  |             |                  |             | 197.00       |                             |
| Care of plant <sup>12</sup> .....         |                  |             |                  |             | 748.11       |                             |
| Repair of plant.....                      |                  |             |                  |             | 2,209.78     |                             |
| Depreciation of plant <sup>13</sup> ..... |                  |             |                  |             | 2,344.39     |                             |
| Total.....                                |                  |             |                  |             | 41,996.03    | 35.11                       |

<sup>1</sup> Includes areas of mats built, not areas of ground covered.<sup>2</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters, or a previous job, to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.<sup>3</sup> The reported cost of the material is the cost delivered on the job.<sup>4</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.<sup>5</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment, are to be charged to plant.<sup>6</sup> This item is the cost of the served ration.<sup>7</sup> This item includes all the expenses of operating the tenders and no others, and excludes all expense of boats in general towing service, and inspection and survey boats.<sup>8</sup> Includes wages of all employed on the work, except those specified in 9.<sup>9</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.<sup>10</sup> In adding total field cost, omit totals under headings "Per square."<sup>11</sup> This item includes actual cost of survey work done on this revetment.<sup>12</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>13</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls 5 per cent for all plant with treated (creosoted) wooden hulls, and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works, there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Conditions at end of year.*—The revetment is in good condition, except for one minor break in upper bank work, which occurred too late in the season to be repaired. Caving below the revetment is only normal. The effective length of the revetment is 8,640 feet.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to make the necessary repairs to maintain the work in good condition.

*Effect of improvement.*—The bank along this front has been held, the levee has been saved, a large area of land has been protected, and the channel has been permanently located.

*(b) Ashbrook Neck, Miss.*

*Location.*—Four hundred and forty-six miles below Cairo, left bank.

*Original condition.*—In 1870 the width of this point at the narrowest place was approximately 4,300 feet. By 1890, caving along the upper side of the point had reduced the width of the neck to 2,300 feet. As there was no reason to expect the caving to stop from natural causes, a cut-off across this neck seemed imminent unless steps were taken to prevent it. A cut-off would have upset the regimen of the river in this locality and would have resulted in the loss of any miles of levee, the destruction of a large area of cultivated land, and bad channel conditions before the river could again adjust its slope.

*Previous projects.*—None.

*Present project.*—While the original project, adopted in 1890, provided for the prevention of a cut-off by the construction of a series of spur dikes on the upper side of the neck to check erosion and the retardation of the flow across the neck by slashings, it was modified during construction to provide continuous revetment in lieu of spur dikes and a levee about 7,000 feet long in lieu of the slashings. The project was further modified in 1915, requiring the construction of an earthen dike or levee to commission grade, about 26,000 feet long, extending from the main levee line to or near the high ground at the west end of Ashbrook Point.

*Operations and results prior to the present year.*—Two spur dikes were partially built; two slashings were made across the neck to cause deposit, and a levee of light section constructed, and 11,150 feet of bank was protected by continuous revetment. In the continuous bank work about 4,000 feet of woven flow mattress was placed, practically all of which had to be subsequently reinforced with fascine mattress. In 1906 about 400 feet of mat was lost as a result of flanking at the ends. The spur dikes, slashings, and bundles failed to produce deposits and the levee was damaged during the floods of 1892 and 1893, and overtopped and destroyed in 1897. The continuous revetment has, however, prevented a cut-off. Two Bucyrus drag-line levee machines were ordered for the construction of the earthen spur dike authorized in 1915. The cost of the work prior to the present fiscal year amounted to \$490,066.31 for original work and extensions and \$320,704 for maintenance, a total of \$810,077.31.

*Operations and results during the present year.*—Delays in completing more urgent work at other points on account of shortage of rock and labor prevented undertaking actual revetment work at this point during the year. Only minor repairs were made. The total expenditures (not including prorated cost of repair, depreciation, and maintenance of plant) amounted to \$1,973.37, all of which was for maintenance.

*Operations and results during the present year.*—On August 10 contract was entered into with the Warrior Timber & Contracting Co. for clearing the right way and grubbing the foundation for the dike. On September 15 the first bag-line excavator was landed on the work, and on September 29, 1916, the second. Work was prosecuted until January 27, when approaching high water made it necessary to shut down and secure the ends of the work. The dike is completed from its outer end for a distance of 14,000 feet, 422,670 cubic yards of material having been placed in it at a unit cost of 6.3 cents per cubic yard. The outer end was protected with paving, 378 squares of concrete having been placed at a cost of \$6,007.08 and 130 squares of stone at a cost of \$1,404.17. The upper end was protected with a brush mat weighted down with rock, 162 squares having been laid at a cost of \$2,049.66. During the high water considerable work was necessary to protect the dike from destruction by the current along the lower end. Expenditures for this work amounted to \$8,373.55. Total expenditures on the dike during the year (exclusive of cost of machines and surveys) amounted to \$44,673.37, of which \$34,250.16 was for new work and \$10,423.21 was for maintenance during the high water.

*Condition at end of the year.*—There is in place 11,150 feet of effective bank protection in good condition and 14,000 feet of earthen dike in good condition except at the outer end. As caving continues below the lower end of the revetment an extension is necessary to prevent the neck from getting any narrower and to prevent the flanking of the work already in place.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to extend the revetment about 3,000 feet downstream and to complete the spur levee, 26,300 feet in length, authorized May 22, 1915.

*Effect of improvement.*—The work accomplished has prevented a cut-off and permanently fixed the channel.

## (c) Panther Forest, Ark.

*Location.*—Four hundred and fifty-two miles below Cairo, right bank.

*Original condition.*—Caving has been in progress since the earliest surveys 1879 and 1880. In 1908 the controlling levee line was threatened at a point where relocation would have been expensive on account of having to cross an old river bed.

*Previous projects.*—None.

*Present project.*—To protect the large and important levee line at this locality and to permanently locate the channel.

*Operations and results prior to the present year.*—Work was commenced in 1908; 2,000 feet of bank was revetted with subaqueous fascine willow mats and riprap upper bank paving. The work was extended down stream 2,150 feet in 1911. As a result of the 1912 and 1913 high waters about 800 linear feet of the work at the upper end was practically destroyed. The damages were repaired in 1914 and the work extended upstream 1,050 feet, but the upper bank work was seriously damaged again during the following high water. These damages were repaired in the fiscal year 1915. In 1916 incomplete repair work left over from the preceding season was finished and the revetment was extended 420 feet upstream. The revetment has been successful in saving the construction of a new levee. The total expenditures prior to the present fiscal year have been \$205,836.20 for original work and extensions and \$190,081.93 for repairs and renewals, a total of \$395,468.13.

*Operations and results during the present year.*—Minor repairs were made, work left unfinished at the close of the preceding season was completed, an upstream extension of 1,000 feet was made, and a gap of 780 feet completed. The work aggregated 6,948 squares of channel and connecting mats; 1,948 squares of upper bank paving, of which 1,133 squares were concrete and 815 squares riprap paving. The location of the work is shown on plate 4 accompanying. Total expenditures (not including prorated amount of cost of car depreciation, and maintenance of plant) were \$84,882.34, of which \$64,627.14 was for new work and \$20,254.92 was for repairs and maintenance. Details of costs and expenditures are given in the table following:

## PANTHER FOREST REVETMENT (452 R.), THIRD DISTRICT.

*Mattresses, total area 6,948 squares (channel, 60 per cent; connecting, 40 per cent).<sup>1</sup>*

## BUILDING MAT.

|                                                       | Quantity used.  |             | Per square. |       |
|-------------------------------------------------------|-----------------|-------------|-------------|-------|
|                                                       | Total quantity. | Total cost. | Quantity.   | Cost. |
| Mobilization and demobilization <sup>2</sup> .....    |                 | \$737.41    |             | \$0.  |
| $\frac{3}{4}$ -inch strand <sup>3</sup> .....pounds.. | 54,027          | 3,888.94    | 7.78        |       |
| $\frac{1}{4}$ -inch strand <sup>3</sup> .....do.....  | 19,136          | 1,094.58    | 2.75        |       |
| $\frac{1}{2}$ -inch strand <sup>3</sup> .....do.....  | 67,906          | 4,278.08    | 9.77        |       |
| Spikes <sup>3</sup> .....do.....                      | 800             | 24.80       | .12         |       |
| Staples <sup>3</sup> .....do.....                     | 1,200           | 44.40       | .17         |       |
| Clips, $\frac{3}{4}$ -inch <sup>3</sup> .....number.. | 350             | 33.25       | .05         |       |
| Clips, $\frac{1}{4}$ -inch <sup>3</sup> .....do.....  | 800             | 88.00       | .12         |       |
| Brush and poles <sup>3</sup> .....cords..             | 11,654          | 14,136.98   | 1.68        | 2.    |
| Rope, manila <sup>3</sup> .....pounds..               | 4,309           | 775.53      | .62         |       |
| Coal <sup>4</sup> .....tons.....                      | 40.4            | 121.20      |             |       |
| Miscellaneous expenses <sup>5</sup> .....             |                 | 1,182.86    |             |       |
| Subsistence <sup>6</sup> .....                        |                 | 3,418.50    |             |       |
| Steamboat expenses <sup>7</sup> .....                 |                 | 206.93      |             |       |
| Labor <sup>8</sup> .....                              |                 | 7,598.82    |             | 1.    |
| Supervision <sup>9</sup> .....                        |                 | 2,044.05    |             |       |
| Total.....                                            |                 | 39,675.33   |             |       |

## BALLASTING AND SINKING.

|                                                    |       |           |      |      |
|----------------------------------------------------|-------|-----------|------|------|
| Mobilization and demobilization <sup>2</sup> ..... |       | \$268.71  |      | \$0. |
| Stone <sup>3</sup> .....tons.....                  | 6,195 | 12,404.25 | 0.89 | 1.   |
| Rope, manila <sup>3</sup> .....pounds..            | 4,308 | 775.53    | .62  |      |
| Miscellaneous expenses <sup>5</sup> .....          |       | 591.43    |      |      |
| Subsistence <sup>6</sup> .....                     |       | 1,046.50  |      |      |
| Steamboat expenses <sup>7</sup> .....              |       | 206.93    |      |      |
| Labor <sup>8</sup> .....                           |       | 2,228.43  |      |      |
| Supervision <sup>9</sup> .....                     |       | 1,022.03  |      |      |
| Total.....                                         |       | 18,643.81 |      |      |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Grading.*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>4</sup> .....tons.              |                 | \$908.20    |             | \$0.211 |
| Oil <sup>4</sup> .....                    |                 | 25.00       |             | .006    |
| Miscellaneous expenses <sup>5</sup> ..... |                 | 305.15      |             | .071    |
| Subsistence <sup>6</sup> .....            |                 | 988.22      |             | .229    |
| Labor <sup>8</sup> .....                  |                 | 3,406.61    |             | .791    |
| Total.....                                |                 | 5,633.18    |             |         |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$593.20    |             | \$0.137 |
| Stone <sup>2</sup> .....tons.                      | 2,264           | 4,532.30    | 2.79        | 5.595   |
| Cement <sup>3</sup> .....sacks.                    | 3,841           | 1,566.36    | 3.39        | 1.383   |
| Sand and gravel <sup>3</sup> .....cubic yards.     | 1,147           | 907.62      | 1.01        | 1.120   |
| Coal <sup>4</sup> .....tons.                       | 42              | 126.52      |             | .052    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 615.37      |             | .317    |
| Subsistence <sup>6</sup> .....                     |                 | 2,514.00    |             | 1.294   |
| Labor <sup>8</sup> .....                           |                 | 5,033.15    |             | 2.590   |
| Supervision <sup>9</sup> .....                     |                 | 1,022.02    |             | .526    |
| Total.....                                         |                 | 16,910.45   |             |         |
| Total field cost <sup>10</sup> .....               |                 | * 80,862.77 |             |         |

*Summary of costs (linear feet revetted, 1,780).*

|                                     | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                     | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....               | \$8.39           | \$58,319.14 | \$11.60          | \$22,543.63 | \$80,862.77  | \$33.84                     |
| Office expenses.....                |                  |             |                  |             | 3,888.07     |                             |
| Surveys <sup>11</sup> .....         |                  |             |                  |             | 132.00       |                             |
| Care of plant <sup>12</sup> .....   |                  |             |                  |             | 1,238.04     |                             |
| Repair of plant <sup>12</sup> ..... |                  |             |                  |             | 3,632.16     |                             |
| Depreciation of plant.....          |                  |             |                  |             | 4,194.10     |                             |
| Total.....                          |                  |             |                  |             | 93,947.14    | 41.40                       |

\* Includes repairs amounting to \$20,254.95.

For explanation of footnotes see Lake Bolivar revetment table (p. 3556).

*Condition at end of year.*—The work is in good condition except for some 3,000 squares of bank paving that could not be placed on account of shortage of materials and now remains to be placed in order to complete the work done during the year. The effective length of the revetment is 7,500 feet. Active caving is in progress for  $1\frac{1}{2}$  miles above the revetment, but further extension can probably be deferred for a season or two.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to complete the work left unfinished at the close of the season.

*Effect of improvement.*—The bank has been held, the levee saved, and the channel permanently located.

(d) *Leland Neck, Ark.*

*Location.*—Four hundred and seventy-one miles below Cairo, right bank.

*Original condition.*—In 1880 the width of the neck at the narrowest point was approximately 5,500 feet. The banks continued to cave at this point until the width of the neck was reduced to 2,600 feet, and it was necessary to revet the bank to prevent a cut-off. A cut-off at this point would have had a disastrous effect on the regimen of the river similar to that described at Ashbrook Neck.

*Previous projects.*—None.

*Present project.*—To prevent a cut-off and fix the channel by bank revetment.

*Operations and results prior to the present year.*—Bank revetment, consisting of fascine mats below the water and riprap paving above, has been placed at this point, as follows: Season 1909–10, approximately 3,000 feet; season 1910–11, 1,000 feet; season 1911–12, approximately 1,000 feet. The cost of work prior to the present fiscal year amounted to \$187,956 for original work and extensions, and \$8,385.66 for maintenance, a total of \$196,341.66.

*Operations and results during the present year.*—No work was done. The expenditures, \$1,013.44, were for surveys and share of cost of care and repairs of plant.

*Condition at end of year.*—The work is in good condition. Effective length is 5,000 feet. A slight caving has set in below the revetment, but has not flanked the revetment to any appreciable extent.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to make necessary repairs to maintain the work in good condition.

*Effect of improvement.*—The revetment placed at this point has protected the bank, prevented a cut-off, and permanently located the channel.

(e) *Greenville Harbor, Miss.*

*Location.*—Four hundred and seventy-eight miles below Cairo, left bank.

*Original condition.*—Caving has been in progress since the earliest surveys—1879–80. During the 12 years from 1882 to 1894 the bank in the Greenville Bend receded about 4,000 feet. A large portion of the town of Greenville had caved into the river and the complete demolition of the remainder of the town and harbor was threatened. New levee loops had been repeatedly constructed to cover the front line, being breached by caving, and been in turn destroyed.

*Previous projects.*—The original project, adopted in 1887, provided for protection of the bank by means of submerged spur dikes.

*Present project.*—Adopted in 1891; provides for protection of the bank with continuous revetment.

*Operations and results prior to the present fiscal year.*—Work under the previous projects commenced in 1887. Twelve submerged crib dikes founded on woven mats and one longitudinal pile dike were placed between 1887 and 1889. During the flood of 1891 the upper four dikes were flanked, and it was then decided to make the mats continuous between the dikes and to adopt the woven-mat type of construction with riprap upper-bank paving, placing the work in continuous stretches. From 1891 to 1894, 14,500 feet of this class of revetment was constructed. In 1896 repeated local failures and breaches indicated the woven type of mats to be too frail; the standard fascine type was adopted and work of reinforcing the entire length of revetment was commenced. From 1896 to 1905, 10,700 feet of the woven mats were thus reinforced. Rapid caving occurred in the bend above the effective revetment, causing excessive flanking each year. In 1910 the effective length of continuous revetment was 12,500 feet and 800 feet of disconnected dikes at the extreme lower end. In 1912 an extension of 1,000 feet was made upstream. The high waters of 1913 caused a failure of about 800 feet below the reinforced mats. In 1913 and 1914 this breach was repaired, the remaining woven mats, with the exception of about 1,000 feet, were reinforced with fascine mats, and a further extension of about 1,000 feet was made upstream. In 1915 and 1916 further extensions of 3,000 and 2,015 feet, respectively, upstream were made and minor repairs made. As a result of this work the bank where revetted has been successfully held; further losses from caving in the town of Greenville prevented and the controlling levee line along the length of revetment protected. The expenditures prior to the present fiscal year have been \$1,136,457.29 for original work and extensions and \$341,943.75 for repairs and renewals, a total of \$1,478,501.04.

*Operations and results during the present year.*—Work left unfinished at the close of the preceding season was completed and an upstream extension of 770 feet was made. A failure of the upper-bank work between stations 11 and 14 and a slough in the bank along the city front just below the end of the vetment, between two of the old spur dikes, were repaired. The work aggregated 3,442 squares of channel, connecting, and pocket mats and 3,019 squares of concrete paving, of which amounts 520 squares of mat work and 926 squares of paving were for maintenance and the balance for extensions. Location of work is shown on plate 5, accompanying. The total expenditures (not including amount of cost of care, depreciation, and maintenance of plant) were \$9,909.81, of which amount \$31,738.34 was for new work and \$8,171.57 for maintenance. Detailed data of cost of work is given in tables following.

## GREENVILLE, MISS. (478 L.), THIRD DISTRICT—NEW WORK.

*matresses, total area 2,922 squares (channel, 92 per cent; connecting, 8 per cent).<sup>1</sup>*

## BUILDING MAT.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>2</sup> ..... |                 | \$240.30    |             | \$0.082 |
| inch strand <sup>3</sup> .....pounds.              | 16,300          | 1,548.50    | 5.58        | .530    |
| inch strand <sup>3</sup> .....do.                  | 10,450          | 597.74      | 3.57        | .204    |
| inch strand <sup>3</sup> .....do.                  | 27,232          | 1,715.62    | 9.32        | .587    |
| ikes <sup>3</sup> .....do.                         | 500             | 15.50       | .17         | .005    |
| aples <sup>3</sup> .....do.                        | 200             | 7.40        | .07         | .003    |
| ush and poles <sup>3</sup> .....cords.             | 4,928           | 5,978.64    | 1.70        | 2.046   |
| ope, manila <sup>3</sup> .....pounds.              | 2,391           | 450.29      | .81         | .151    |
| al <sup>4</sup> .....tons.                         | 47              | 139.92      |             | .048    |
| scellaneous expenses <sup>5</sup> .....            |                 | 496.77      |             | .170    |
| bsistence <sup>6</sup> .....                       |                 | 1,356.50    |             | .464    |
| amboat expenses <sup>7</sup> .....                 |                 | 132.45      |             | .045    |
| bor <sup>8</sup> .....                             |                 | 2,937.38    |             | 1.005   |
| persivision <sup>9</sup> .....                     |                 | 549.41      |             | .181    |
| Total.....                                         |                 | 16,166.42   |             |         |

## BALLASTING AND SINKING.

|                                                   |       |          |      |         |
|---------------------------------------------------|-------|----------|------|---------|
| obilization and demobilization <sup>2</sup> ..... |       | \$120.15 |      | \$0.041 |
| one <sup>3</sup> .....tons.                       | 2,169 | 4,307.79 | 0.74 | 1.474   |
| ope, manila <sup>3</sup> .....pounds.             | 2,390 | 450.29   | .82  | .154    |
| scellaneous expenses <sup>5</sup> .....           |       | 248.84   |      | .085    |
| bsistence <sup>6</sup> .....                      |       | 341.50   |      | .117    |
| amboat expenses <sup>7</sup> .....                |       | 132.50   |      | .045    |
| bor <sup>8</sup> .....                            |       | 860.54   |      | .295    |
| persivision <sup>9</sup> .....                    |       | 274.70   |      | .094    |
| Total.....                                        |       | 6,736.31 |      |         |

## Grading.

|                                         | Quantity used.  |             | Per square. |         |
|-----------------------------------------|-----------------|-------------|-------------|---------|
|                                         | Total quantity. | Total cost. | Quantity.   | Cost.   |
| al <sup>4</sup> .....tons.              |                 | \$136.23    |             | \$0.170 |
| scellaneous expenses <sup>5</sup> ..... |                 | 3.50        |             | .004    |
| bsistence <sup>6</sup> .....            |                 | 7.50        |             | .009    |
| bor <sup>8</sup> .....                  |                 | 125.98      |             | .157    |
| bor <sup>8</sup> .....                  |                 | 468.53      |             | .586    |
| Total.....                              |                 | 741.74      |             |         |

*Paving.*

|                                                | Quantity used.  |             | Per square. |        |
|------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization <sup>2</sup>   |                 | \$120.15    |             |        |
| Stone <sup>3</sup> .....tons.                  | 135             | 270.31      | 2.70        | \$5.40 |
| Cement <sup>3</sup> .....sacks.                | 7,521           | 3,067.06    | 3.51        | 1.43   |
| Sand and gravel <sup>3</sup> .....cubic yards. | 2,259           | 1,787.55    | 1.05        | .82    |
| Coal <sup>4</sup> .....tons.                   | 58              | 122.68      | .03         | .07    |
| Miscellaneous expenses <sup>5</sup>            |                 | 281.18      |             | .12    |
| Subsistence <sup>6</sup>                       |                 | 1,280.50    |             | .55    |
| Labor <sup>8</sup>                             |                 | 2,668.41    |             | 1.21   |
| Supervision <sup>9</sup>                       |                 | 274.71      |             | .12    |
| Total.....                                     |                 | 9,922.55    |             |        |
| Total field cost <sup>10</sup> .....           |                 | * 33,587.02 |             |        |

\* Includes repairs amounting to \$4,068.10.

*Summary of costs (linear feet revetted, 1,070).*

|                                     | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                     | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....               | \$7.84           | \$22,902.73 | \$4.86           | \$10,664.29 | \$33,567.02  | \$29.60                     |
| Office expenses.....                |                  |             |                  |             | 1,801.42     |                             |
| Surveys <sup>11</sup> .....         |                  |             |                  |             | 438.00       |                             |
| Care of plant <sup>12</sup> .....   |                  |             |                  |             | 1,074.90     |                             |
| Repair of plant <sup>13</sup> ..... |                  |             |                  |             | 3,124.56     |                             |
| Depreciation of plant.....          |                  |             |                  |             | 3,607.90     |                             |
| Total.....                          |                  |             |                  |             | 43,613.80    | 36.60                       |

For explanation of footnotes see Lake Bolivar revetment table (p. 3556).

## GREENVILLE, MISS. (478 L.), THIRD DISTRICT—REPAIR WORK.

*Mattresses, total area 520 squares (connecting, 100 per cent).<sup>1</sup>*

## BUILDING MAT.

|                                                      | Quantity used.  |             | Per square. |        |
|------------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                      | Total quantity. | Total cost. | Quantity    | Cost.  |
| Mobilization and demobilization <sup>2</sup>         |                 | \$118.41    |             | \$0.22 |
| $\frac{3}{4}$ -inch strand <sup>3</sup> .....pounds. | 2,898           | 208.66      | 5.57        | .40    |
| $\frac{1}{2}$ -inch strand <sup>3</sup> .....do.     | 1,706           | 97.58       | 3.28        | .18    |
| $\frac{1}{4}$ -inch strand <sup>3</sup> .....do.     | 4,955           | 312.17      | 9.53        | 6.00   |
| Spikes <sup>3</sup> .....do.                         | 50              | 1.55        | .01         | .00    |
| Staples <sup>3</sup> .....do.                        | 150             | 5.55        | .29         | .01    |
| Clips, $\frac{3}{4}$ -inch <sup>3</sup> .....number. | 20              | 1.90        | .04         | .00    |
| Clips, $\frac{1}{2}$ -inch <sup>3</sup> .....do.     | 10              | 1.10        | .02         | .00    |
| Brush and poles <sup>3</sup> .....cords.             | 902             | 1,090.94    | 1.75        | 2.08   |
| Subsistence <sup>6</sup>                             |                 | 150.00      |             | .22    |
| Labor <sup>8</sup>                                   |                 | 299.13      |             | .56    |
| Supervision <sup>9</sup>                             |                 | 42.53       |             | .08    |
| Total.....                                           |                 | 2,329.52    |             |        |

## BALLASTING AND SINKING.

|                               |     |            |   |        |
|-------------------------------|-----|------------|---|--------|
| Stone <sup>3</sup> .....tons. | 520 | \$1,041.20 | 1 | \$2.00 |
| Subsistence <sup>6</sup>      |     | 58.50      |   | .11    |
| Labor <sup>8</sup>            |     | 92.46      |   | .18    |
| Supervision <sup>9</sup>      |     | 18.50      |   | .08    |
| Total.....                    |     | 1,210.66   |   |        |

*Grading.*

|                                      | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| ..... tons.....                      | 44              | \$132.00    | 0.07        | \$0.220 |
| .....                                |                 | 7.50        |             | .012    |
| .....                                |                 | 111.50      |             | .186    |
| .....                                |                 | 312.29      |             | .525    |
| Total.....                           |                 | 563.29      |             |         |
| Total field cost <sup>10</sup> ..... |                 | 4,103.47    |             |         |

*Summary of costs.*

|                       | Subaqueous work. |            | Upper bank work, total. | Grand total. |
|-----------------------|------------------|------------|-------------------------|--------------|
|                       | Persquare.       | Total.     |                         |              |
| Total field cost..... | \$6.81           | \$3,540.18 | \$563.29                | \$4,103.47   |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—The effective length of the revetment is 21,660 ft. The condition of the work is good, except that placed to repair the slough just below the lower end of the revetment. This work failed near the close of the season, and could not be repaired before high water. Only slight caving taking place at the upper end of the revetment. No caving is occurring below the revetment.

*Local cooperation.*—The town of Greenville contributed \$42,277.10 in 1887.

*Proposed operations.*—It is proposed to extend the revetment approximately 1,000 feet downstream and to make such repairs as may be necessary for maintenance.

*Effect of improvement.*—The bank in this bend, as far as revetted, has been held and the channel has been permanently located. The entire city of Greenville has been protected, confidence in the stability of the river bank has been restored, permitting the city to grow normally without fear of destruction, and further expensive retirements of the controlling levee line have been made unnecessary.

*(f) Vacluse, Ark.*

*Location.*—Four hundred and eighty-seven miles below Cairo, right bank.

*Original condition.*—The levee at this point was built near the lower end of the Chicot, and could not be set back without great cost. Caving has been in progress since the earliest surveys, 1879–80, and had caused the bank to approach so close to the levee as to endanger its further life unless revetment was placed.

*Previous projects.*—None.

*Present project.*—The present project is to protect the levee by means of continuous bank revetment.

*Operations and results prior to the present year.*—Bank revetment consisting of fascine mats below the water and riprap paving above has been placed at this point, as follows: Season of 1908–9, approximately 2,000 feet; season of 1910–11, approximately 1,000 feet; and season of 1911–12, approximately 1,000 feet. This revetment effectively checked the caving, except for a slight flanking at the upper end, which was repaired during the fiscal year 1915. The total cost of work prior to the present fiscal year amounted to \$161,042 for original work and extensions and \$9,812.16 for repairs and maintenance, a total of \$170,854.16.

*Operations and results during the present year.*—Repairs were made to the upper bank work where failures had occurred. The work aggregated 1,655 squares of connecting mat and 252 squares of concrete paving. Shortage of

material resulted in leaving unfinished 400 squares of paving. Expenditure amounted to \$13,512.44, all of which was for maintenance. Location of work is shown on plate 6, accompanying. Details of cost of work are given in the following table:

*Mattresses, total area 1,655 squares (connecting 100 per cent).*

VAUCLUSE, ARK. (487 R.), THIRD DISTRICT.

BUILDING MAT.

|                                                       | Quantity used.  |             | Per square. |        |
|-------------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                       | Total quantity. | Total cost. | Quantity.   | Cost   |
| Mobilization and demobilization <sup>2</sup>          |                 | \$60.00     |             | \$0.00 |
| $\frac{3}{8}$ -inch strand <sup>3</sup> .....pounds.. | 8,227           | 592.14      | 4.97        | .3     |
| $\frac{7}{16}$ -inch strand <sup>3</sup> .....do..... | 5,428           | 310.48      | 3.28        | .1     |
| $\frac{1}{2}$ -inch strand <sup>3</sup> .....do.....  | 25,262          | 1,391.51    | 15.21       | .8     |
| Spikes <sup>3</sup> .....do.....                      | 210             | 6.51        | .13         | .0     |
| Staples <sup>3</sup> .....do.....                     | 105             | 3.88        | .06         | .0     |
| Clips, $\frac{3}{8}$ -inch <sup>3</sup> .....number.. | 25              | 2.26        | .02         | .0     |
| Clips, $\frac{1}{2}$ -inch <sup>3</sup> .....do.....  | 25              | 2.75        | .02         | .0     |
| Brush and poles <sup>3</sup> .....cords..             | 2,271           | 2,748.39    | 1.37        | 1.6    |
| Coal <sup>4</sup> .....tons..                         | 70              | 208.44      | .04         | .1     |
| Miscellaneous expenses <sup>5</sup> .....             |                 | 25.00       |             | .0     |
| Subsistence <sup>6</sup> .....                        |                 | 587.50      |             | .3     |
| Labor <sup>8</sup> .....                              |                 | 1,350.31    |             | .8     |
| Supervision <sup>9</sup> .....                        |                 | 140.10      |             | .0     |
| Total.....                                            |                 | 7,429.27    |             |        |

BALLASTING AND SINKING.

|                                |       |            |      |       |
|--------------------------------|-------|------------|------|-------|
| Stone <sup>3</sup> .....tons.. | 1,285 | \$2,569.80 | 0.72 | \$1.5 |
| Subsistence <sup>6</sup> ..... |       | 132.00     |      | .0    |
| Labor <sup>8</sup> .....       |       | 263.75     |      | .1    |
| Supervision <sup>9</sup> ..... |       | 23.10      |      | .0    |
| Total.....                     |       | 2,988.65   |      |       |

*Grading.*

|                                | Quantity used.  |             | Per square. |       |
|--------------------------------|-----------------|-------------|-------------|-------|
|                                | Total quantity. | Total cost. | Quantity.   | Cost  |
| Coal <sup>4</sup> .....tons..  | 146.8           | \$440.40    | 0.21        | \$0.6 |
| Oil <sup>4</sup> .....         |                 | 5.00        |             | .0    |
| Subsistence <sup>6</sup> ..... |                 | 166.00      |             | .2    |
| Labor <sup>8</sup> .....       |                 | 477.62      |             | .6    |
| Total.....                     |                 | 1,089.02    |             |       |

*Paving.*

|                                                 | Quantity used.  |             | Per square. |       |
|-------------------------------------------------|-----------------|-------------|-------------|-------|
|                                                 | Total quantity. | Total cost. | Quantity.   | Cost  |
| Cement <sup>3</sup> .....sacks..                | 820             | \$334.40    | 3.25        | \$1.3 |
| Sand and gravel <sup>3</sup> .....cubic yards.. | 235             | 185.96      | .93         | .7    |
| Coal <sup>4</sup> .....tons..                   | 10              | 28.56       | .04         | .1    |
| Subsistence <sup>6</sup> .....                  |                 | 399.00      |             | 1.7   |
| Labor <sup>8</sup> .....                        |                 | 736.87      |             | 2.9   |
| Supervision <sup>9</sup> .....                  |                 | 38.50       |             | .1    |
| Total.....                                      |                 | 1,857.50    |             |       |
| Total field cost <sup>10</sup> .....            |                 | 13,364.44   |             |       |

*Summary of costs.*

|                                     | Subaqueous work. |               | Upper bank work. |              | Grand total.  |
|-------------------------------------|------------------|---------------|------------------|--------------|---------------|
|                                     | Per square.      | Total.        | Per square.      | Total.       |               |
| Total field cost.....               | \$6. 29          | \$10, 417. 92 | \$11. 69         | \$2, 946. 52 | \$13, 364. 44 |
| Office expenses.....                |                  |               |                  |              | 75. 00        |
| Surveys <sup>11</sup> .....         |                  |               |                  |              | 73. 00        |
| Care of plant <sup>12</sup> .....   |                  |               |                  |              | 261. 43       |
| Repair of plant <sup>13</sup> ..... |                  |               |                  |              | 767. 04       |
| Depreciation of plant.....          |                  |               |                  |              | 885. 53       |
| Total.....                          |                  |               |                  |              | 15, 426. 44   |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—There is in place 3,925 feet of effective bank protection in good condition except for upper bank paving left unfinished at close of season. Slight flanking is taking place at the upper end.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to make such repairs as may be needed and to check flanking at the upper end if necessary.

*Effect of improvement.*—The work accomplished has protected the bank, thus obviating the necessity of building a new and expensive loop, and has permanently located the channel.

(g) *Longwood, Miss.*

*Location.*—Five hundred miles below Cairo, left bank.

*Original condition.*—Caving has been in progress since the earliest surveys—1879-80. In 1904 the Longwood Levee, one of the largest on the river, was threatened and careful investigation proved that bank revetment would be cheaper than a relocation of the levee.

*Previous projects.*—None.

*Present project.*—To protect the large and important levee line at this locality by bank revetment.

*Operations and results prior to the present year.*—Work was commenced in 1904, and during the season 1904-5, 4,200 feet of standard fascine revetment was placed. The work was successful in stopping the caving; no extensions have been needed and no repairs have been made. The work is now shielded from the direct flow of the main channel of the river by a sand bar which began to form opposite the work in 1906. The total expenditure prior to the present year has been \$153,607.08, all for original construction and share in cost of annual surveys.

*Operations and results during the present year.*—No work was required. The expenditures, \$844.38, were for surveys and share of cost of care, repairs, and depreciation of plant.

*Condition at end of year.*—The effective length of the work is 4,200 feet, all in good condition and shielded from the direct flow of the main channel of the river by a sand bar which has formed opposite the work.

*Local cooperation.*—The Board of Mississippi Levee Commissioners contributed \$11,009.45 in 1905.

*Proposed operations.*—None.

*Effect of improvement.*—The caving which had been proceeding for more than 25 years was effectively checked. The construction of a levee loop estimated to cost \$793,000 was obviated with an expenditure of a little over \$150,000. The channel has been permanently located.

(h) *Grand Lake, Ark.*

*Location.*—Five hundred and ten miles below Cairo, right bank.

*Original condition.*—The levee at this point was built across the bed of Grand Lake, where a new loop would have been very expensive. Caving has been in progress since the earliest surveys—1879-80—and by 1911 had so reduced the distance between the bank and the levee as to make it essential to eitherrevet the bank or build a new levee.

*Previous projects.*—None.

*Present project.*—To protect the levee and fix the channel at this point by means of continuous bank revetment.

*Operations and results prior to the present year.*—During the season 1911–12, 3,900 feet of bank revetment consisting of fascine mats below the water and rip-rap paving above was placed. This work was extended upstream 1,800 feet during 1914–15 season. Minor repairs have been made from time to time. The revetment placed has effectively checked the caving along the bank protected. The total expenditures for work prior to the present fiscal year amounted to \$259,903.66 for original work and extensions and \$6,523 for maintenance, a total of \$266,426.66.

*Operations and results during the present year.*—No work was done during the year. Expenditures, which amounted to \$1,688.76, were for surveys, and share of cost of care, repairs, and depreciation of plant.

*Condition at end of year.*—There is in place 8,500 feet of revetment, all in good condition, except for some minor breaks in the upper bank paving. Caving continues above the revetment, and a further extension upstream will eventually be necessary. Caving has again set in below the revetment, and an extension downstream will be necessary in the near future.

*Local cooperation.*—None.

*Proposed operations.*—Such repairs as may be necessary will be made.

*Effect of improvement.*—The work accomplished has permanently fixed the channel, protected the bank, and obviated the necessity of building a new and costly levee.

#### (i) Lake Providence Reach.

*Location.*—Five hundred and seventeen to five hundred and fifty miles below Cairo.

*Original condition.*—This and Plum Point Reach were originally selected by the commission for improvement, on account of the exceptional difficulties encountered there. Caving was excessive; the channel was not clearly defined, being divided into numerous branches by islands, and depths as small as 4½ feet were occasionally found on its crossings.

*Previous projects.*—The original project adopted in 1881 provided for securing a low-water channel with an approximately uniform width of 3,000 feet, by constructing contraction works, closing all chutes, and holding caving banks. In 1896, due to the development of hydraulic dredging, the project for the reach as a whole was definitely abandoned, with the exception of repairs to revetments.

*Present project.*—Repairs to revetments.

*Operations and results prior to the present year.*—To close chutes and diminish the low-water width of the river, permeable dikes were constructed at Duncansby Crossing, Cottonwood, Mayersville, Elton, Baleshed, and Stack Island, and have been fully described in the early reports of the commission. Their first effect was very beneficial. A deposit of from 6 to 18 feet was found behind them the first season; chutes were closed, and the river at low water contracted and confined to a single channel of the width prescribed in the project. During the years 1884 and 1885 the least depth on crossings was 11 feet.

The early efforts to revet caving banks were unsuccessful. The width given to the subaqueous mats did not exceed 150 feet, and they probably contained an insufficient amount of brush to prevent scour through them. They were rapidly undermined and destroyed, leaving the contraction works exposed to attack. On account of lack of funds for several years, and by reason of the proviso of the river and harbor act of August 5, 1886, which prohibited the construction of revetment works, attempts to prevent the banks from caving were not resumed until 1889. During the intervening period a rapid increase in the rate of caving in this reach was observable; dikes on the concave side of bends were flanked and destroyed; when they were constructed on the convex side, by the caving of the opposite bank the low-water channel was removed from their sphere of influence, and by 1888 the width of the low-water channel had materially increased.

While, however, the changes in the river channel have been great, the abnormal conditions which existed prior to the construction of contraction works have not reappeared, and the river tends to flow in a single channel during

low water, even where the works to confine it to that channel have been destroyed. It has resulted that, though bars form which are obstructive to navigation, the river currents more rapidly cut a channel through them than formerly. Since the resumption of revetment construction in 1889 work has been limited to the revetment of Louisiana Bend and Lake Providence. At Louisiana Bend 5,820 feet of bank was revetted between 1889 and 1893, which was repaired in 1896 and 1897. Since that date it has received no attention, and 4,520 feet have been lost by flanking at its lower end. At Lake Providence 12,800 feet of bank was revetted between 1894 and 1896, and as this work not only was a portion of the general project for the improvement of the reach, but also protected a large levee across the foot of Lake Providence and the town of the same name, the revetment has been maintained and at present has an effective length of 12,600 feet.

The expenditures on this reach have amounted to \$3,943,668.70; included herein is an expenditure on the revetment at Lake Providence of \$383,983 for original work and extensions and \$182,112.24 for maintenance, a total of \$66,095.24.

*Operations and results during the present year.*—None. The expenditures, which amounted to \$4,787.86, were for surveys, and share of cost of care and repairs of plant.

*Local cooperation.*—None.

*Proposed operations.*—None.

(j) *Fitlers Bend, Miss.*

*Location.*—Five hundred and fifty miles below Cairo, left bank.

*Original condition.*—Caving has been in progress since the earliest surveys, 1879–80. In 1906 the large levee at Fitlers became endangered from caving, and investigations showed revetment to be cheaper than a relocation of the levee.

*Previous projects.*—None.

*Present project.*—To fix the channel, and prevent the destruction of the conalling levee line at this point by bank revetment.

*Operations and results prior to the present year.*—Work was commenced in 1907 when 2,000 feet of standard fascine revetment was placed, which was extended 1,000 feet upstream in 1910, and 200 feet downstream to check flanking in 1911, making a total of 3,200 feet. In 1912 the rapid caving below the revetment necessitated a further extension downstream of 600 feet. A gap of 300 feet was left unprotected, and then 5,200 feet of revetment was placed to protect a long line of levee in immediate danger of caving off. The lower reach of work was extended upstream 1,000 feet and downstream 1,900 feet in 1913–14, which reduced the unprotected gap to 1,300 feet. Repairs have been made from time to time as necessary. The work has been entirely successful, but was severely damaged by the high water of 1916. The expenditures prior to the present year have been \$468,628 for original work and extensions, and \$69,222.63 for repairs and renewals, a total of \$537,850.63.

*Operations and results during the year.*—Work was commenced August 17, 1916, and the gap originally left in the revetment was closed. Extensive repair work was next undertaken to replace the work lost during and following the 1916 high water, and continued until in March, 1917. Shortage of material and approaching high water made it impossible to complete all the repair work needed. In closing the gap, which was new work, 3,300 squares of channel mat and 1,396 squares of concrete bank paving was placed. On the repair work 1,159 squares of channel and connecting mats were placed. It was impossible to place any upper bank paving on account of shortage of material. Location of work is shown on plate 7 accompanying. The total expenditures (excluding prorated cost of care, depreciation, and maintenance of plant) were \$16,012.96, of which amount \$33,073.90 was for new work, and \$82,939.06 for maintenance. Details of cost of work are given in the tables following:

# 3568 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

FITLERS BEND, MISS. (550 L.), THIRD DISTRICT—NEW WORK.

Mattresses, total area 3,300 squares (channel, 83 per cent; connecting, 17 per cent).<sup>1</sup>

## BUILDING MAT.

|                                                       | Quantity used.  |             | Per square. |        |
|-------------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization <sup>2</sup> .....    |                 | \$326. 22   |             | \$0.09 |
| $\frac{1}{8}$ -inch strand <sup>3</sup> .....pounds.. | 26,046          | 1,875. 31   | 7. 89       | .50    |
| $\frac{1}{4}$ -inch strand <sup>3</sup> .....do.....  | 6,680           | 382. 10     | 2. 03       | .11    |
| $\frac{1}{2}$ -inch strand <sup>3</sup> .....do.....  | 39,767          | 2,518. 49   | 12. 10      | .76    |
| Spikes <sup>3</sup> .....do.....                      | 1,500           | 46. 50      | .46         | .00    |
| Staples <sup>3</sup> .....do.....                     | 613             | 22. 68      | .18         | .00    |
| Clips, $\frac{1}{8}$ -inch <sup>3</sup> .....number.. | 275             | 19. 80      | .09         | .11    |
| Clips, $\frac{1}{4}$ -inch <sup>3</sup> .....do.....  | 175             | 10. 01      | .05         | .00    |
| Brush and poles <sup>3</sup> .....cords..             | 5,608           | 6,990. 78   | 1. 70       | 2.11   |
| Rope, manila <sup>3</sup> .....pounds..               | 725             | 130. 50     | .22         | .04    |
| Coal <sup>4</sup> .....tons..                         | 32              | 96. 00      |             | .02    |
| Miscellaneous expenses <sup>5</sup> .....             |                 | 254. 23     |             | .07    |
| Subsistence <sup>6</sup> .....                        |                 | 1,458. 00   |             | .44    |
| Steamboat expenses <sup>7</sup> .....                 |                 | 35. 00      |             | .01    |
| Labor <sup>8</sup> .....                              |                 | 2,689. 56   |             | .81    |
| Supervision <sup>9</sup> .....                        |                 | 200. 00     |             | .00    |
| Total.....                                            |                 | 17,055. 18  |             |        |

## BALLASTING AND SINKING.

|                                                    |       |           |       |        |
|----------------------------------------------------|-------|-----------|-------|--------|
| Mobilization and demobilization <sup>2</sup> ..... |       | \$163. 11 |       | \$0.00 |
| Stone <sup>3</sup> .....tons..                     | 3,300 | 6,607. 59 | 1. 00 | 2.00   |
| Rope, manila <sup>3</sup> .....pounds..            | 725   | 130. 50   | .22   | .04    |
| Coal <sup>4</sup> .....tons..                      | 2     | 6. 00     |       | .00    |
| Miscellaneous expenses <sup>5</sup> .....          |       | 127. 11   |       | .00    |
| Subsistence <sup>6</sup> .....                     |       | 284. 50   |       | .00    |
| Steamboat expenses <sup>7</sup> .....              |       | 35. 00    |       | .00    |
| Labor <sup>8</sup> .....                           |       | 534. 31   |       | .10    |
| Supervision <sup>9</sup> .....                     |       | 99. 50    |       | .00    |
| Total.....                                         |       | 7,987. 62 |       |        |

## Grading.

|                                | Quantity used.  |             | Per square. |        |
|--------------------------------|-----------------|-------------|-------------|--------|
|                                | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Coal <sup>4</sup> .....tons..  | 140             | \$420. 00   | 0. 08       | \$0.20 |
| Oil <sup>4</sup> .....         |                 | 15. 00      |             | .00    |
| Subsistence <sup>6</sup> ..... |                 | 253. 50     |             | .10    |
| Labor <sup>8</sup> .....       |                 | 1,118. 08   |             | .60    |
| Total.....                     |                 | 1,806. 58   |             |        |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |          |
|----------------------------------------------------|-----------------|-------------|-------------|----------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.    |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$163. 10   |             | \$0. 088 |
| Cement <sup>3</sup> .....sacks.....                | 2, 841          | 1, 158. 76  | 2. 04       | . 830    |
| Sand and gravel <sup>3</sup> .....cubic yards..... | 863             | 682. 89     | . 62        | . 489    |
| Coal <sup>4</sup> .....tons.....                   | 37              | 111. 90     | . 02        | . 060    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 127. 12     |             | . 068    |
| Subsistence <sup>6</sup> .....                     |                 | 1, 089. 00  |             | . 586    |
| Labor <sup>8</sup> .....                           |                 | 2, 066. 98  |             | 1. 111   |
| Total.....                                         |                 | 5, 399. 75  |             |          |
| Total field cost <sup>10</sup> .....               |                 | 32, 249. 13 |             |          |

*Summary of costs (linear feet revetted, 1,300).*

|                                     | Subaqueous work. |               | Upper bank work. |              | Grand total.  | Total cost per linear foot. |
|-------------------------------------|------------------|---------------|------------------|--------------|---------------|-----------------------------|
|                                     | Per square.      | Total.        | Per square.      | Total.       |               |                             |
| Total field cost.....               | \$7. 59          | \$25, 042. 80 | \$3. 87          | \$7, 206. 33 | \$32, 249. 13 | \$25. 44                    |
| Office expenses.....                |                  |               |                  |              | 824. 77       |                             |
| Surveys <sup>11</sup> .....         |                  |               |                  |              |               |                             |
| Care of plant <sup>12</sup> .....   |                  |               |                  |              | 1, 538. 00    |                             |
| Repair of plant <sup>13</sup> ..... |                  |               |                  |              | 4, 512. 00    |                             |
| Depreciation of plant.....          |                  |               |                  |              | 5, 280. 00    |                             |
| Total.....                          |                  |               |                  |              | 44, 403. 90   | 34. 15                      |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

## FITLERS BEND, MISS. (550 L.), THIRD DISTRICT—REPAIR WORK.

Mattresses, total area, 11,159 squares (channel, 75 per cent; connecting, 25 per cent).<sup>1</sup>

## BUILDING MAT.

|                                                    | Quantity used.  |              | Per square. |          |
|----------------------------------------------------|-----------------|--------------|-------------|----------|
|                                                    | Total quantity. | Total cost.  | Quantity.   | Cost.    |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$1, 205. 15 |             | \$0. 108 |
| 3-inch strand <sup>3</sup> .....pounds.....        | 66, 263         | 4, 770. 94   | \$5. 94     | . 427    |
| 4-inch strand <sup>3</sup> .....do.....            | 39, 969         | 1, 286. 23   | 3. 58       | . 115    |
| 5-inch strand <sup>3</sup> .....do.....            | 88, 023         | 5, 545. 45   | 7. 89       | . 497    |
| Pikes <sup>3</sup> .....do.....                    | 2, 640          | 81. 84       | . 24        | . 007    |
| Slips, 3-inch <sup>3</sup> .....number.....        | 300             | 28. 50       | . 03        | . 003    |
| Slips, 4-inch <sup>3</sup> .....do.....            | 460             | 50. 60       | . 03        | . 005    |
| Brush and poles <sup>3</sup> .....cords.....       | 15, 459         | 19, 631. 28  | 1. 39       | 1. 759   |
| Rope, manila <sup>3</sup> .....pounds.....         | 3, 684          | 660. 12      | . 33        | . 059    |
| Coal <sup>4</sup> .....tons.....                   | 26              | 79. 20       |             | . 007    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 440. 91      |             | . 040    |
| Subsistence <sup>6</sup> .....                     |                 | 3, 511. 50   |             | . 315    |
| Teamboat expenses <sup>7</sup> .....               |                 | 268. 42      |             | . 024    |
| Labor <sup>8</sup> .....                           |                 | 7, 864. 84   |             | . 705    |
| Supervision <sup>9</sup> .....                     |                 | 1, 177. 00   |             | . 105    |
| Total.....                                         |                 | 46, 601. 98  |             |          |

## BALLASTING AND SINKING.

|                                            |        |               |         |          |
|--------------------------------------------|--------|---------------|---------|----------|
| 1-ton <sup>3</sup> .....tons.....          | 8, 713 | \$17, 445. 24 | \$0. 78 | \$1. 563 |
| Rope, manila <sup>3</sup> .....pounds..... | 3, 684 | 660. 12       | . 33    | . 059    |
| Coal <sup>4</sup> .....tons.....           | 10     | 30. 00        |         | . 003    |
| Miscellaneous expenses <sup>5</sup> .....  |        | 330. 91       |         | . 030    |
| Subsistence <sup>6</sup> .....             |        | 1, 765. 50    |         | . 151    |
| Teamboat expenses <sup>7</sup> .....       |        | 268. 43       |         | . 024    |
| Labor <sup>8</sup> .....                   |        | 3, 368. 30    |         | . 302    |
| Supervision <sup>9</sup> .....             |        | 927. 00       |         | . 083    |
| Total.....                                 |        | 24, 795. 50   |         |          |

*Grading.*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>4</sup> .....tons.....          | 645             | \$1,934.00  | 0.11        | \$0.322 |
| Oil <sup>4</sup> .....                    |                 | 50.00       |             | .008    |
| Miscellaneous expenses <sup>5</sup> ..... |                 | 110.00      |             | .018    |
| Subsistence <sup>6</sup> .....            |                 | 952.50      |             | .159    |
| Labor <sup>8</sup> .....                  |                 | 2,732.45    |             | .455    |
| Total.....                                |                 | 5,778.99    |             |         |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |        |
|----------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Stone <sup>2</sup> .....tons.....                  | 195             | \$390.00    | \$3.90      | \$7.80 |
| Cement <sup>3</sup> .....sacks.....                | 1,033           | 421.26      | 3.54        | 1.408  |
| Sand and gravel <sup>3</sup> .....cubic yards..... | 296             | 234.22      | 1.00        | .802   |
| Coal <sup>4</sup> .....tons.....                   | 7               | 20.40       |             | .060   |
| Subsistence <sup>6</sup> .....                     |                 | 437.00      |             | 1.272  |
| Labor <sup>8</sup> .....                           |                 | 741.81      |             | 2.168  |
| Supervision <sup>9</sup> .....                     |                 | 250.00      |             | .731   |
| Total.....                                         |                 | 2,949.60    |             |        |
| Total field cost <sup>10</sup> .....               |                 | 79,671.16   |             |        |

*Summary of costs.*

|                                     | Subaqueous work. |             | Upper bank work, total. | Grand total. |
|-------------------------------------|------------------|-------------|-------------------------|--------------|
|                                     | Per square.      | Total.      |                         |              |
| Total field cost.....               | \$6.40           | \$71,297.48 | \$8,273.68              | \$79,671.16  |
| Office expenses.....                |                  |             |                         | 3,158.90     |
| Surveys <sup>11</sup> .....         |                  |             |                         | 109.00       |
| Care of plant <sup>12</sup> .....   |                  |             |                         | 230.40       |
| Repair of plant <sup>13</sup> ..... |                  |             |                         | 676.80       |
| Depreciation of plant.....          |                  |             |                         | 781.50       |
| Total.....                          |                  |             |                         | 84,627.82    |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—The effective length of the revetment is 8,450 feet. The work is in good condition above the gap, but the work below the gap is in such bad condition as to be almost a total loss.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to repair the work below the gap and to make such other repairs as may be necessary.

*Effect of improvement.*—Caving has been effectively checked along the full reach revetted, and the channel has been fixed in position. The relocation of a long line of levee has been obviated.

(k) *Cottonwood, Miss.*

*Location.*—Five hundred and fifty-eight miles below Cairo, left bank.

*Original condition.*—Prior to 1913 this bank had been relatively stable for many years, but following the 1913 flood serious caving set in, which amounted to 400 feet in 1914, 1,100 feet in 1915, and 1,500 feet in 1916. In 1915 a new levee

was constructed about 1,000 feet back of the old levee, but the caving of the following season destroyed a considerable portion of the work and it became evident that it would be necessary either to fix the channel by means of revetment or else build a levee across the point and throw out a large area of land. Revetment was therefore decided upon.

*Previous projects.*—None.

*Present projects.*—To protect the bank, fix the channel in position, and protect the levee by means of continuous revetment along the caving bank in this bend.

*Operations and results prior to the present year.*—None.

*Operations and results during the year.*—Work was commenced on September 26, 1916, and continued until March 22, 1917, when high water prevented further operations. Channel mats were sunk covering the bank for a distance of 8,060 feet. The upper bank was paved with concrete to full height for 4,000 feet and to half height for the balance of the distance, except for about 1,900 feet where the last mat was sunk at practically a bank-full stage. The work, all of which was new work, aggregated 23,420 squares of channel and connecting mat and 5,894 squares of concrete paving. The work prevented further caving, except along the last mat sunk, where an ugly pocket formed before the mat could be gotten down, but even then the caving was not sufficient to seriously threaten the levee. Location of work is shown on plate 8 accompanying. Expenditures (excluding prorated cost of care, depreciation, and maintenance of plant) amount to \$210,573.66, all for new work. Detailed cost of work is given in the following table:

COTTONWOOD, MISS. (558 L.), THIRD DISTRICT.

*Mattresses, total area, 23,420 squares (channel, 87 per cent; connecting 13 per cent).<sup>1</sup>*

BUILDING MAT.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$1,486.71  |             | \$0.063 |
| 1-inch strand <sup>3</sup> .....pounds.            | 151,958         | 10,940.98   | 6.49        | .467    |
| 2-inch strand <sup>3</sup> .....do.                | 77,985          | 4,460.74    | 3.33        | .194    |
| 3-inch strand <sup>3</sup> .....do.                | 211,226         | 13,307.24   | 9.02        | .568    |
| Spikes <sup>4</sup> .....do.                       | 3,000           | 93.00       | .13         | .004    |
| Staples <sup>5</sup> .....do.                      | 3,000           | 111.00      | .13         | .005    |
| Clips, 3/4-inch <sup>6</sup> .....number           | 475             | 34.20       | .12         | .001    |
| Clips, 7/16-inch <sup>6</sup> .....number          | 375             | 21.45       | .12         | .001    |
| Brush and poles <sup>8</sup> .....cords            | 38,051          | 48,701.74   | 1.62        | 2.037   |
| Boys, Manila <sup>9</sup> .....pounds.             | 7,367           | 1,326.06    | .31         | .057    |
| Boys <sup>9</sup> .....tons.                       | 272             | 815.88      | .01         | .035    |
| Fiscellaneous expenses <sup>9</sup> .....          |                 | 1,847.40    |             | .079    |
| Subsistence <sup>6</sup> .....                     |                 | 9,530.00    |             | .407    |
| Teamboat expenses <sup>7</sup> .....               |                 | 475.00      |             | .020    |
| Labor <sup>8</sup> .....                           |                 | 19,228.65   |             | .821    |
| Supervision <sup>9</sup> .....                     |                 | 2,835.17    |             | .121    |
| Total.....                                         |                 | 115,215.22  |             |         |

BALLASTING AND SINKING.

|                                           |        |             |      |         |
|-------------------------------------------|--------|-------------|------|---------|
| Boys <sup>9</sup> .....tons.              | 17,786 | \$35,590.85 | 0.79 | \$1.520 |
| Boys, Manila <sup>9</sup> .....pounds.    | 7,367  | 1,326.06    | .31  | .057    |
| Boys <sup>9</sup> .....tons.              | 112    | 336.00      |      | .014    |
| Fiscellaneous expenses <sup>9</sup> ..... |        | 923.70      |      | .039    |
| Subsistence <sup>6</sup> .....            |        | 2,242.50    |      | .096    |
| Teamboat expenses <sup>7</sup> .....      |        | 475.00      |      | .020    |
| Labor <sup>8</sup> .....                  |        | 4,748.12    |      | .203    |
| Supervision <sup>9</sup> .....            |        | 1,417.59    |      | .061    |
| Total.....                                |        | 47,059.83   |      |         |

*Grading.*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>4</sup> .....tons.....          | 548             | \$1,645.20  | 0.07        | \$0.216 |
| Oil <sup>4</sup> .....                    |                 | 45.00       |             | .006    |
| Miscellaneous expenses <sup>5</sup> ..... |                 | 250.00      |             | .033    |
| Subsistence <sup>6</sup> .....            |                 | 1,461.50    |             | .192    |
| Labor <sup>8</sup> .....                  |                 | 3,529.13    |             | .464    |
| Total.....                                |                 | 6,930.83    |             |         |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Stone <sup>3</sup> .....tons.....                  | 741             | \$1,499.85  | 3.25        | \$6.666 |
| Cement <sup>3</sup> .....sacks.....                | 19,995          | 8,153.96    | 3.57        | 1.455   |
| Sand and gravel <sup>3</sup> .....cubic yards..... | 7,587           | 6,003.59    | 1.35        | 1.071   |
| Coal <sup>4</sup> .....tons.....                   | 215             | 645.00      | .03         | .107    |
| Oil <sup>4</sup> .....                             |                 | 25.00       |             | .004    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 923.70      |             | .153    |
| Subsistence <sup>6</sup> .....                     |                 | 4,704.50    |             | .780    |
| Labor <sup>8</sup> .....                           |                 | 10,349.00   |             | 1.715   |
| Supervision <sup>9</sup> .....                     |                 | 1,417.18    |             | .235    |
| Total.....                                         |                 | 33,721.78   |             |         |
| Total field cost <sup>10</sup> .....               |                 | 202,927.66  |             |         |

*Summary of costs (linear feet revetted, 8,060).*

|                                     | Subaqueous work. |              | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------|------------------|--------------|------------------|-------------|--------------|-----------------------------|
|                                     | Per square.      | Total.       | Per square.      | Total.      |              |                             |
| Total field cost.....               | \$6.92           | \$162,275.05 | \$6.74           | \$40,652.61 | \$202,927.66 | \$25.13                     |
| Office expenses.....                |                  |              |                  |             | 7,500.00     |                             |
| Surveys <sup>11</sup> .....         |                  |              |                  |             | 146.00       |                             |
| Care of plant <sup>12</sup> .....   |                  |              |                  |             | 2,782.09     |                             |
| Repair of plant <sup>13</sup> ..... |                  |              |                  |             | 8,163.27     |                             |
| Depreciation of plant.....          |                  |              |                  |             | 9,424.81     |                             |
| Total.....                          |                  |              |                  |             | 230,943.83   | 28.65                       |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—The effective length of the revetment is 8,060 feet. The work is in good condition except along the last mat placed, where a new channel mat, some connecting mats, and upper bank paving will have to be placed, and except for uncompleted bank paving and some minor breaks in completed paving.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to complete the unfinished bank paving, repair breaks in paving, and replace the last mat sunk with new mats and bank paving properly located.

*Effect of improvement.*—Caving has been checked in the revetted reach except at one point. The channel has been fixed in position. The new and expensive levee just completed has been saved from destruction.

*(l) Albemarle Bend, Miss.*

*Location.*—Five hundred and sixty-eight miles below Cairo, left bank.

*Original condition.*—The bank in this bend has caved back  $2\frac{1}{2}$  miles since the survey of 1879–80, and destroyed many miles of levees and thousands of acres of valuable land. On account of the proximity of Goose Lake, Five Mile Lake, and Steele Bayou behind the existing levee, there was no suitable economical location for a new loop, and it therefore became necessary to take steps to prevent further caving in the bend.

*Previous projects.*—None.

*Present project.*—To protect the levee in this bend by means of continuous bank revetment.

*Operations and results prior to the present year.*—During the season of 1910–1, approximately 11,650 feet of bank was revetted—10,000 feet with fascine mat work and 1,550 feet with sectional mat work, below the water—all with riprap paving above the water. During the season of 1912–13 an extension of 2,070 feet was made downstream. A great many repairs have been necessary in this bend to maintain the work in good condition. The breaks were mostly due to bad drainage. During the season of 1911–12 inshore breaks of about 1,800 feet were repaired, and in 1912–13 it was necessary to completely renew 1,035 feet of revetment. During the high waters of 1913 the formation of a channel through the sand bar, which now has become practically the main channel of the river, has so changed conditions that during high and medium stages there are two navigable channels—one around the bend and the other across the point. At extreme low water the old way around the bend is not navigable, and seems to be gradually closing up. The cost of work prior to the present year amounted to \$486,038 for original work and extensions, and \$148,109.92 for maintenance, a total of \$634,147.92.

*Operations and results during the present year.*—No work was done. Expenditures, which amounted to \$2,815.13, were for surveys and for this improvement's share in care, repair, and maintenance of plant.

*Condition at end of year.*—Work is in good condition, except for minor breaks in upper bank work. Effective length 13,720 feet. The main channel of the river is now across the bar and away from the revetment. Further extensions probably will be unnecessary.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to maintain the work in good condition.

*Local cooperation.*—None.

*Effect of improvement.*—The work accomplished has protected the bank, and obviated the necessity of building a new levee at great cost.

*(m) Delta Point, La.*

*Location.*—Five hundred and ninety-eight miles below Cairo, right bank.

*Original condition.*—Succeeding the Centennial cut-off in 1876, very rapid caving occurred on Delta Point and in the bend above, and the subsequent shoaling of the channel leading from the river along the Vicksburg front, practically destroyed the harbor at Vicksburg for low-water commerce.

*Previous projects.*—In connection with the improvement of Vicksburg Harbor (see I n) the protection of Delta Point with bank revetment was authorized in the river and harbor act approved June 18, 1873.

*Present project.*—The river and harbor act approved August 2, 1882, placed this work under the supervision of the Mississippi River Commission. The continued protection of the point with bank revetment is proposed.

*Operations and results prior to the present year.*—Under previous projects, between 1879 and 1882, 5,400 feet of woven mat revetments, mats 150 to 175 feet wide, and one spur dike and two screen dikes were constructed at a total cost of \$203,229.87. Between the date of the transfer of the work to the commission in 1882 and 1885 about 6,500 feet of woven mats 300 feet wide and riprap upper bank work were placed, largely reinforcing the old revetment. Extensive repairs were made in 1899–1900. From 1901 to 1912 the work stood in good condition, no repairs being necessary. In 1912 a part of the old woven mattress work at the lower end failed, necessitating considerable repairs and an extension of standard fascine mats downstream. No repairs have been necessary since. The work has been successful in maintaining the point in exactly the same position as when work was commenced in 1879. The expenditures prior to the present year have been \$420,546 for original work, reinforcements, and extensions, and \$36,416.29 for repairs and maintenance, a total of \$456,962.29.

*Operations and results during the present year.*—No work was done. The expenditures, \$1,182.30, were for surveys and this work's share of the cost of care and repairs of plant.

*Condition at end of year.*—The effective length of the revetment is 5,900 feet, all in good condition.

*Local cooperation.*—None.

*Proposed operations.*—Maintenance.

*Effect of improvement.*—Delta Point has been held in exactly the same position as when work was commenced in 1879. The channel of the river has been prevented from being deflected farther away from Vicksburg Harbor..

(n) *Mouth of Yazoo River and Harbor at Vicksburg, Miss.*

*Location.*—Five hundred and ninety-nine miles below Cairo, left bank.

*Original condition.*—Prior to 1876 the Mississippi River made a bend to the northeastward near the town of Delta, and another sharp bend to the southward just above the city of Vicksburg, flowing in a southerly direction in front of the city. In 1876 the river cut across the narrow neck of land lying in this sharp bend. Rapid caving followed in the cut-off and immediately above, causing the main channel to move to the southward, and the old channel in front of Vicksburg to fill, thus threatening to leave Vicksburg on a lake instead of on an open channel.

*Previous projects.*—The original project adopted by the river and harbor act approved June 18, 1878, provided for the protection of Delta Point, the construction of a bar dike, dredging out the inner harbor, and the diversion into Centennial Lake of the Yazoo River. In 1887 this project was modified to dredging a basin in front of the city to be connected to the river at Kleinston Landing by a canal; the basin to be inclosed on its north and west sides by an earthen dam to be constructed from the material dredged so as to limit the inflow of water during floods, and thus reduce the amount of deposit.

*Present project.*—The present project, adopted by the river and harbor act approved July 13, 1892, provides for the diversion of Yazoo River through an old bed of the Yazoo, and thence through Lake Centennial along the Vicksburg front to the Mississippi River.

*Operations and results prior to the present year.*—Between 1878 and 1881 there was built 5,400 linear feet of revetment at Delta Point, one mattress spur dike, and two screen dikes. The river and harbor act of August 2, 1882, placed this work under the Mississippi River Commission, and from this year until 1892 work was limited to revetment at Delta Point and dredging. The river and harbor act of August 18, 1894, transferred the work to the Engineer Department proper. Between 1892 and 1905 a canal was dredged across the low land between Old River and Lake Centennial, and the east arm of Lake Centennial in front of the city of Vicksburg was deepened, thus securing a 6-foot channel from the Mississippi River along the front of Vicksburg and thence to the Yazoo River proper. A levee dike, known as the West Pass Levee, was built in 1904 from the mouth of the canal below Vicksburg Harbor, westward along the West Pass Bar for a distance of 8,800 feet, with a view to confining the outflow of Yazoo River to the canal and breaking up the eddy action through the harbor division. The dike was enlarged in 1910. The river and harbor act approved March 4, 1913, transferred the work back again to the Mississippi River Commission, which has maintained the improvement since that date. The total expenditures prior to the present year were \$1,244,665.11, of which amount \$65,464.14 was for maintenance.

*Operations and results during the present year.*—No work was done, high stage of river throughout the year rendering work unnecessary. The maximum depth that can be carried at extreme low water is 3½ feet. On October 9, 1916, the balance of funds on hand and in the Treasury was transferred to the Vicksburg (Miss.) engineer district.

*Condition at end of year.*—Boats drawing 6 feet have access to the city of Vicksburg at all stages of water. The canal in front of the city has shoaled to a depth of 3½ feet at a point near the upper limits of the city. Some shoaling has also occurred at the point where the canal debouches into Lake Centennial, thus limiting the draft of boats ascending the Yazoo to 3 feet at extreme low water.

*Local cooperation.*—None.

*Proposed operations.*—This work is now under charge of the Vicksburg, Miss., engineer district.

*Effect of improvement.*—A good harbor has been maintained at Vicksburg.

(c) *Vicksburg revetment.*

*Location.*—Five hundred and ninety-nine miles below Cairo, left bank.

*Original condition.*—Subsequent to the cut-off, which occurred in 1876, and prior to the construction of the canal which diverted the Yazoo River along the Vicksburg front, this stretch of bank was not exposed to any current action, and even after the completion of the diversion canal it suffered no damage until the excessively high floods of 1912 and 1913, although the original section of the canal prism had scoured out to some extent. During the 1912 and 1913 floods unusually large amounts of water were discharged through the canal as a result of crevasses in the levee system and caused serious caving along the bank just above the point where the canal enters the Mississippi. Further caving occurred during succeeding high water, resulting in heavy losses to the Vicksburg, Shreveport & Pacific Railway, which was compelled to relocate its tracks, and to the compress companies established on the bank. If permitted to continue, the caving would have compelled the railroad to abandon its present point for crossing the Mississippi and would have destroyed considerable portions of the cotton bolls belonging to the compress companies. Revetment was therefore determined upon.

*Previous projects.*—None.

*Present project.*—To protect the bank by revetment, and thus save valuable properties, of a more or less public nature, from serious loss or destruction.

*Operations and results prior to the present year.*—None.

*Operations and results during the present year.*—Work was commenced in November and the bank revetted for a distance of 1,800 feet from the lower end of the reach to be protected; 4,024 squares of reinforced concrete mat and 2,419 squares of concrete bank paving were placed. Location of work is shown on plate 9. The total expenditures (excluding pro rata of cost of surveys, and care, depreciation, and maintenance of plant) amount to \$51,314.17, all for new work, detailed cost of work is given in following table:

## VICKSBURG HARBOR (599 L.), THIRD DISTRICT.

*Mattresses, total area 4,024 squares (channel, 100 per cent).<sup>1</sup>*

## BUILDING MAT.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>2</sup> ..... |                 | \$209.08    |             | \$0.052 |
| wire mesh <sup>3</sup> .....                       |                 |             |             |         |
| squares .....                                      | 4,508           | 4,472.76    | 1.12        | 1.111   |
| pounds .....                                       | 4,577           | 423.37      | 1.14        | .150    |
| number .....                                       |                 | 1,391.04    |             | .343    |
| pounds .....                                       |                 | 753.57      |             | .187    |
| sacks .....                                        | 12,760          | 5,231.60    | 3.17        | 1.300   |
| cubic yards .....                                  | 38,517          | 2,542.32    | .95         | .632    |
| tons .....                                         | 93              | 279.00      | .02         | .069    |
| .....                                              |                 | 50.00       |             | .012    |
| .....                                              |                 | 1,391.17    |             | .346    |
| .....                                              |                 | 738.50      |             | .183    |
| .....                                              |                 | 2,191.37    |             | .544    |
| .....                                              |                 | 285.15      |             | .078    |
| Total .....                                        |                 | 19,958.93   |             |         |

## BALLASTING AND SINKING.

|                                                    |        |           |       |         |
|----------------------------------------------------|--------|-----------|-------|---------|
| mobilization and demobilization <sup>2</sup> ..... |        | \$209.08  |       | \$0.052 |
| inch strand .....                                  | 62,382 | 4,054.83  | 15.50 | 1.008   |
| ips, ½ inch <sup>3</sup> .....                     | 24,260 | 1,637.55  | 6.04  | .407    |
| ope, manila <sup>2</sup> .....                     |        | 753.57    |       | .187    |
| al <sup>4</sup> .....                              |        | 180.00    | .01   | .014    |
| tons .....                                         | 63     | 1,391.17  |       | .346    |
| .....                                              |        | 555.50    |       | .138    |
| .....                                              |        | 1,714.27  |       | .426    |
| .....                                              |        | 285.15    |       | .078    |
| Total .....                                        |        | 10,790.12 |       |         |

*Grading.*

|                                       | Quantity used.  |             | Per square. |        |
|---------------------------------------|-----------------|-------------|-------------|--------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Coal <sup>4</sup> .....tons..         | 157.1           | \$478.26    | 0.06        | \$1.30 |
| Oil <sup>4</sup> .....                |                 | 3.70        |             | .00    |
| Subsistence <sup>6</sup> .....        |                 | 1,446.50    |             | .40    |
| Steamboat expenses <sup>7</sup> ..... |                 | 315.85      |             | .00    |
| Labor <sup>8</sup> .....              |                 | 3,784.07    |             | 1.00   |
| Total.....                            |                 | 6,028.38    |             |        |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |        |
|----------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$309.08    |             | \$0.08 |
| Rope, manila <sup>3</sup> .....pounds..            |                 | 753.57      |             | .31    |
| Cement <sup>3</sup> .....sacks..                   | 12,095          | 4,958.95    | 5.00        | 2.00   |
| Sand and gravel <sup>3</sup> .....cubic yards..    | 3,802           | 2,509.32    | 1.57        | 1.03   |
| Coal <sup>4</sup> .....tons..                      | 57              | 171.00      | .02         | .07    |
| Oil <sup>4</sup> .....                             |                 | 50.00       |             | .00    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 1,391.17    |             | .57    |
| Subsistence <sup>6</sup> .....                     |                 | 369.50      |             | .15    |
| Labor <sup>8</sup> .....                           |                 | 1,120.00    |             | .46    |
| Supervision <sup>9</sup> .....                     |                 | 285.15      |             | .11    |
| Total.....                                         |                 | 11,817.74   |             |        |
| Total field cost <sup>10</sup> .....               |                 | 48,595.17   |             |        |

*Summary of costs (linear feet revetted, 1,800).*

|                                     | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                     | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....               | \$7.64           | \$30,749.05 | \$7.38           | \$17,846.12 | \$48,595.17  | \$26.90                     |
| Office expenses.....                |                  |             |                  |             | 2,500.00     |                             |
| Surveys <sup>11</sup> .....         |                  |             |                  |             | 219.00       |                             |
| Care of plant <sup>12</sup> .....   |                  |             |                  |             | 872.58       |                             |
| Repair of plant <sup>13</sup> ..... |                  |             |                  |             | 1,534.08     |                             |
| Depreciation of plant.....          |                  |             |                  |             | 1,771.27     |                             |
| Total.....                          |                  |             |                  |             | 55,492.10    | 30.80                       |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—The effective length of the revetment is 1,800 feet all of which is in good condition.

*Local cooperation.*—None.

*Proposed operations.*—It is proposed to extend the revetment upstream, and complete the protection of the caving bank.

*Effect of improvement.*—The revetment in place protects the tracks of the Vicksburg, Shreveport & Pacific Railway from caving into the river.

*(p) Reid-Bedford Bend, La.*

*Location.*—Six hundred and three miles below Cairo, right bank.

*Original condition.*—Caving has progressed steadily since the surveys of 1879-80, and the bank receded about  $1\frac{1}{2}$  miles between that time and 1906, when the bank had approached so close to the levee as to threaten its existence. The land behind the levee is low and swampy and would have rendered the relocation

the levee expensive and difficult. The bend is also very difficult to revet on account of sloughing banks, where large sections settle slowly and slide out, and up water and swift current close to the shore.

*Previous projects.*—None.

*Present project.*—To protect the bank, fix the channel in position, and protect the levee by means of continuous revetment along the caving bank in front of the levee.

*Operations and results prior to the present year.*—Work was commenced in 1906, when about 2,000 feet of fascine mat work was placed, but on account of high water no upper-bank work was possible. One mat, 761 by 250 feet, was sunk, but three were successfully sunk. In 1908 the work was extended 1,400 feet upstream, and the upper bank along both old and new work was graded and paved with riprap. Brush protections were also placed on the upper bank both up and down stream ends of the work. In 1909 and 1910 the work was extended 960 feet upstream by fascine mats and riprap upper-bank paving.

1910–11 a further extension upstream of 1,880 feet was made by the fourth strip by means of sectional mats and riprap upper-bank paving, and in the following year another upstream extension of 1,000 feet was made by the third strip by means of fascine mats and riprap upper-bank paving. In 1914 a 10-foot fascine mat was sunk at the lower end of the work to replace a defective one placed in 1906–7. The total expenditures have been \$380,915 for original work and extensions and \$46,428.76 for repairs and maintenance, a total of \$427,343.76.

*Operations and results during the present year.*—Work was commenced December 29, 1916, the earliest date on which it was practicable to spare plant from other pressing work, and was continued until January 10, 1917, when approaching high water compelled it to stop. One mat, 530 feet long and aggregating 1,325 square feet, was sunk opposite the exposed angle, about 3,600 feet below the lower end of the existing revetment. Location of the work is shown on plate 10. Total expenditures (excluding pro rata of cost of surveys, and care, depreciation, and maintenance of plant) amounted to \$15,206.14, all for new work. Detailed statement of work is given in the following table:

REID-BEDFORD BEND, I.A. (604 R.), THIRD DISTRICT.

Mattresses, total area 1,325 squares (channel, 100 per cent).<sup>1</sup>

BUILDING MAT.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>2</sup> ..... |                 | \$472.56    |             | \$0.357 |
| 1-inch strand <sup>3</sup> .....                   | 12,248 pounds.. | 1,163.56    | 9.24        | .878    |
| 1-inch strand <sup>3</sup> .....                   | 1,075 do.....   | 61.49       | .81         | .016    |
| 1-inch strand <sup>3</sup> .....                   | 19,541 do.....  | 1,231.08    | 14.67       | .929    |
| 1-1/2 inch strand <sup>3</sup> .....               | 200 do.....     | 6.20        | .15         | .005    |
| 1-1/2 inch strand <sup>3</sup> .....               | 300 do.....     | 11.10       | .23         | .008    |
| 1-1/2 inch strand <sup>3</sup> .....               | 2,257 do.....   | 2,843.82    | 1.70        | 2.146   |
| 1-1/2 inch strand <sup>3</sup> .....               | 2,278 do.....   | 410.14      | 1.72        | .309    |
| 1-1/2 inch strand <sup>3</sup> .....               | 10 tons.....    | 30.84       | .01         | .023    |
| 1-1/2 inch strand <sup>3</sup> .....               |                 | 287.05      |             | .217    |
| 1-1/2 inch strand <sup>3</sup> .....               |                 | 431.00      |             | .325    |
| 1-1/2 inch strand <sup>3</sup> .....               |                 | 112.50      |             | .085    |
| 1-1/2 inch strand <sup>3</sup> .....               |                 | 831.21      |             | .627    |
| 1-1/2 inch strand <sup>3</sup> .....               |                 | 431.11      |             | .325    |
| Total .....                                        |                 | 8,323.66    |             |         |

BALLASTING AND SINKING.

|                                                    |              |          |      |         |
|----------------------------------------------------|--------------|----------|------|---------|
| mobilization and demobilization <sup>2</sup> ..... |              | \$236.28 |      | \$0.178 |
| 1-inch strand <sup>3</sup> .....                   | 1,011 tons.. | 2,085.20 | 0.79 | 1.574   |
| 1-inch strand <sup>3</sup> .....                   |              | 287.04   |      | .217    |
| 1-inch strand <sup>3</sup> .....                   |              | 128.50   |      | .017    |
| 1-inch strand <sup>3</sup> .....                   |              | 112.50   |      | .085    |
| 1-inch strand <sup>3</sup> .....                   |              | 301.17   |      | .231    |
| 1-inch strand <sup>3</sup> .....                   |              | 215.56   |      | .163    |
| Total .....                                        |              | 3,369.25 |      |         |

*Grading.*

|                                                    | Quantity used.  |             | Per square. |        |
|----------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$236.28    |             | \$0.19 |
| Coal <sup>4</sup> ..... tons.....                  | 140             | 420.00      | 0.12        | .30    |
| Miscellaneous expenses <sup>6</sup> .....          |                 | 255.00      |             | .2     |
| Subsistence <sup>6</sup> .....                     |                 | 622.00      |             | .5     |
| Steamboat expenses <sup>7</sup> .....              |                 | 25.00       |             | .0     |
| Labor <sup>8</sup> .....                           |                 | 1,422.95    |             | 1.14   |
| Total.....                                         |                 | 2,981.23    |             | .....  |
| Total field cost <sup>10</sup> .....               |                 | 14,674.14   |             | .....  |

*Summary of costs (linear feet revetted, 530).*

|                                     | Subaqueous work. |             | Upper bank work, total. | Grand total. |
|-------------------------------------|------------------|-------------|-------------------------|--------------|
|                                     | Per square.      | Total.      |                         |              |
| Total field cost.....               | \$8.82           | \$11,692.91 | \$2,981.23              | \$14,674.14  |
| Office expenses.....                |                  |             |                         | 313.0        |
| Surveys <sup>11</sup> .....         |                  |             |                         | 219.0        |
| Care of plant <sup>12</sup> .....   |                  |             |                         | 196.0        |
| Repair of plant <sup>13</sup> ..... |                  |             |                         | 575.0        |
| Depreciation of plant.....          |                  |             |                         | 664.0        |
| Total*.....                         |                  |             |                         | 16,641.0     |

\* Work not completed.

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition at end of year.*—The work is in good condition. Due to bad drainage there are a number of small slides visible at low stage of the river. Further extensions downstream will probably be needed in the near future.

*Local cooperation.*—None.

*Proposed operations.*—Such work as may be necessary for maintenance, and an extension downstream of work started last season.

*Effect of improvement.*—The work accomplished at this point has fixed the channel in location and protected the bank and an important line of levee, thus obviating the necessity of building a new and costly levee.

*(q) Cummins, Ark.*

*Location.*—Arkansas River, 72 miles above mouth.

*Original condition.*—The rapidly caving bank at this point threatened the destruction of the levee protecting the State farm.

*Previous projects.*—None.

*Present project.*—The protection of the State farm levee by means of continuous bank revetment. This project was adopted in accordance with special provisions in the river and harbor act approved July 25, 1912.

*Operations and results prior to the present year.*—During 1913, 2,000 feet of bank was protected by means of fascine subaqueous mats and riprap upper bank paving. During the high water of 1914 this work was flanked at both ends. In 1914 extensions were made at both ends, bringing the total length of revetment up to 2,744 feet. Flanking continued at both ends of the work, indicating that it would be impossible to hold the work unless extensions of considerable length were made. The total expenditures amounted to \$52,025 for original work and extensions and \$228 for maintenance. The work was not successful.

*Operations and results during the present year.*—No work done on account of lack of funds.

*Condition at end of year.*—The work was destroyed by the 1915 floods in the Arkansas.

*Local cooperation.*—None.

*Proposed operations.*—None.

*Effect of improvement.*—The work postponed for a few years the moving back the levee line, and thus permitted a few years' more use to be made of the land protected by the levee.

(r) *Red Fork, Ark.*

*Location.*—Arkansas River, 23 miles above mouth.

*Original condition.*—A rapidly caving bank threatened the destruction of a levee across the end of Lake Belcoe, the destruction of which would have necessitated building a loop of considerable length.

*Previous projects.*—None.

*Present project.*—Adopted 1907, provides for the protection of levee between Lake Belcoe and river bank by means of bank protection where caving threatens the levee.

*Operations and results prior to the present year.*—During 1908-9, 1,200 feet of bank was protected by fascine subaqueous mats and riprap upper bank paving. This work has successfully protected the levee it was built to save. The total expenditures prior to the present year were \$16,987 for original work and \$1,948.25 for maintenance, a total of \$21,935.25.

*Operations and results during the present year.*—On January 27, 1917, work repairing and extending the revetment downstream was commenced. A total of 1,230 squares of reinforced concrete mat work and 190 squares of concrete upper bank paving was placed to repair breaks in old work, and 2,809 squares of reinforced concrete mat was placed, extending existing revetment 1,800 feet downstream. Location of the work is shown on plate 2, accompanying. Total expenditures (exclusive of prorated cost of care, depreciation, and maintenance of plant) amounted to \$40,556.38, of which \$30,776.28 was for new work and \$9,780.10 for maintenance. Details of cost of work are shown in the following table:

RED FORK, ARK., ARKANSAS RIVER, THIRD DISTRICT.

*Mattresses, total area 5,680 squares.<sup>1</sup>*

BUILDING MAT.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>2</sup> ..... |                 | \$969.78    |             | \$0.171 |
| wire mesh .....                                    | 5,680           | 5,509.60    | 1.00        | .970    |
| upper .....                                        | 5,824           | 538.72      | 1.03        | .095    |
| rope, manila <sup>3</sup> .....                    | do.             | 250.00      |             | .044    |
| cement <sup>4</sup> .....                          | 13,290          | 5,419.66    | 2.34        | .954    |
| sand and gravel <sup>5</sup> .....                 | 5,342           | 2,820.58    | .93         | .497    |
| coal <sup>6</sup> .....                            | 72              | 216.00      | .01         | .038    |
| miscellaneous expenses <sup>5</sup> .....          |                 | 476.27      |             | .084    |
| subsistence <sup>6</sup> .....                     |                 | 1,111.50    |             | .196    |
| steamboat expenses <sup>7</sup> .....              |                 | 842.11      |             | .148    |
| labor <sup>8</sup> .....                           |                 | 1,973.91    |             | .341    |
| supervision <sup>9</sup> .....                     |                 | 205.62      |             | .036    |
| Total .....                                        |                 | 20,333.75   |             |         |

BALLASTING AND SINKING.

|                                                    |        |           |       |         |
|----------------------------------------------------|--------|-----------|-------|---------|
| mobilization and demobilization <sup>2</sup> ..... |        | \$969.78  |       | \$0.240 |
| inch strand .....                                  | 73,894 | 4,285.85  | 18.30 | 1.061   |
| 1/2-inch <sup>3</sup> .....                        | 24,411 | 1,647.74  | 6.04  | .408    |
| rope, manila <sup>3</sup> .....                    | do.    | 250.00    |       | .062    |
| coal <sup>4</sup> .....                            | 180    | 540.00    | .04   | .134    |
| miscellaneous expenses <sup>5</sup> .....          |        | 476.27    |       | .118    |
| subsistence <sup>6</sup> .....                     |        | 1,059.00  |       | .262    |
| steamboat expenses <sup>7</sup> .....              |        | 842.11    |       | .208    |
| labor <sup>8</sup> .....                           |        | 2,231.38  |       | .552    |
| supervision <sup>9</sup> .....                     |        | 205.63    |       | .051    |
| Total .....                                        |        | 12,507.76 |       |         |

*Grading.*

|                                                    | Quantity used.  |             | Per square. |       |
|----------------------------------------------------|-----------------|-------------|-------------|-------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost. |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$314.92    |             | \$0.1 |
| Coal <sup>4</sup> .....tons..                      | 138.8           | 416.40      | 0.05        | .1    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 158.92      |             | .0    |
| Subsistence <sup>6</sup> .....                     |                 | 436.50      |             | .1    |
| Steamboat expenses <sup>7</sup> .....              |                 | 278.70      |             | .0    |
| Labor <sup>8</sup> .....                           |                 | 1,344.03    |             | .4    |
| Total.....                                         |                 | 2,949.47    |             |       |

*Paving.*

|                                                    | Quantity used.  |             | Per square. |       |
|----------------------------------------------------|-----------------|-------------|-------------|-------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost. |
| Mobilization and demobilization <sup>2</sup> ..... |                 | \$314.92    |             | \$1.6 |
| Cement <sup>3</sup> .....sacks..                   | 886             | 361.31      | 4.66        | 1.9   |
| Sand and gravel <sup>3</sup> .....cubic yards..    | 300             | 158.40      | 1.57        | .8    |
| Coal <sup>4</sup> .....tons..                      | 20              | 60.00       | .10         | .3    |
| Miscellaneous expenses <sup>5</sup> .....          |                 | 158.93      |             | .3    |
| Subsistence <sup>6</sup> .....                     |                 | 194.00      |             | 1.0   |
| Steamboat expenses <sup>7</sup> .....              |                 | 280.70      |             | 1.4   |
| Labor <sup>8</sup> .....                           |                 | 454.39      |             | 2.3   |
| Supervision <sup>9</sup> .....                     |                 | 136.75      |             | .7    |
| Total.....                                         |                 | 2,119.40    |             |       |
| Total field cost <sup>10</sup> .....               |                 | *37,910.38  |             |       |

\* Includes repairs amounting to \$9,780.10.

*Summary of costs.*

|                                     | Subaqueous work. |             | Upper bank work, total. | Grand total. |
|-------------------------------------|------------------|-------------|-------------------------|--------------|
|                                     | Per square.      | Total.      |                         |              |
| Total field cost.....               | \$6.67           | \$32,841.51 | \$5,068.87              | \$37,910.38  |
| Office expenses.....                |                  |             |                         | 2,500.00     |
| Surveys <sup>11</sup> .....         |                  |             |                         | 146.00       |
| Care of plant <sup>12</sup> .....   |                  |             |                         | 649.50       |
| Repair of plant <sup>13</sup> ..... |                  |             |                         | 1,917.60     |
| Depreciation of plant.....          |                  |             |                         | 2,214.00     |
| Total.....                          |                  |             |                         | 45,337.50    |

For explanation of footnotes see Lake Bolivar Revetment table (p. 3556).

*Condition of work at end of the year.*—The effective length is 1,200 feet which is in good condition and serves to protect the Lake Belcoe Levee. Work is in progress. Repairs are completed, but none of the extensions. Mats have been sunk for 1,800 linear feet on the extension. Repairs as well as extensions will be necessary from time to time.

*Local cooperation.*—None.

*Proposed operations.*—Repairs and extension downstream.

*Effect of improvement.*—The revetment has fixed the channel in location and prevented the Lake Belcoe Levee from being breached by the caving river bank and thus obviated the necessity of a new and expensive levee.

*Mississippi River Commission, third district—Data of cost of revetment, June 1, 1916, to May 31, 1917.*

| Location.                  | Expended as per financial statement. | Debits to material on hand. | Credit by material on hand. | Total field cost. | Unit field cost. |                  | Unit overhead cost. |                  |
|----------------------------|--------------------------------------|-----------------------------|-----------------------------|-------------------|------------------|------------------|---------------------|------------------|
|                            |                                      |                             |                             |                   | Per square.      | Per linear foot. | Per square.         | Per linear foot. |
| lake Bolivar, Miss. ....   | \$34,599.53                          | \$3,577.00                  | \$1,482.78                  | \$36,693.75       | \$8.12           | \$30.08          | \$1.65              | \$5.04           |
| Shbrook Neck, Miss. ....   | 7,009.87                             | 26,499.50                   | 31,536.00                   | 1,973.37          |                  |                  |                     |                  |
| Antler Forest, Ark. ....   | 84,565.38                            | 21,617.00                   | 21,299.54                   | 84,882.84         | 8.98             | 33.84            | 1.47                | 7.56             |
| Greenville, Miss. ....     | 40,987.03                            | 9,262.41                    | 10,339.53                   | 39,909.91         | 6.68             | 29.66            | 1.79                | 6.29             |
| Quail, Ark. ....           | 13,512.44                            |                             |                             | 13,512.44         | 7.08             |                  | 1.01                |                  |
| Clair, Miss. ....          | 116,723.37                           | 11,778.00                   | 12,488.41                   | 116,012.96        | 6.74             | 25.44            | 1.00                | 8.71             |
| Cliftonwood, Miss. ....    | 207,597.56                           |                             | 2,976.10                    | 210,573.66        | 6.91             | 25.18            | .92                 | 3.47             |
| Clarksburg, Miss. ....     | 69,726.34                            |                             | 18,412.17                   | 51,314.17         | 7.53             | 26.95            | 1.08                | 3.88             |
| Bed-Bedford Bend, La. .... | 23,509.62                            |                             | 8,303.48                    | 15,206.14         | 11.07            |                  | 1.49                |                  |
| Bed Fork, Ark. ....        | 54,880.38                            |                             | 14,324.00                   | 40,556.38         | 6.46             |                  | 1.26                |                  |

| Location.                  | Work accomplished.    |                           | Total cost of work. | Gross unit cost. <sup>1</sup> |                  | Remarks.                                              |
|----------------------------|-----------------------|---------------------------|---------------------|-------------------------------|------------------|-------------------------------------------------------|
|                            | Squares. <sup>2</sup> | Linear feet. <sup>3</sup> |                     | Per square.                   | Per linear foot. |                                                       |
| lake Bolivar, Miss. ....   | 4,296                 | 1,050                     | \$41,996.03         | \$9.77                        | \$35.12          | Total cost includes repairs amounting to \$5,112.06.  |
| Shbrook Neck, Miss. ....   |                       |                           | 1,973.37            |                               |                  | Clearing for next season's work.                      |
| Antler Forest, Ark. ....   | 8,991                 | 1,780                     | 93,947.14           | 10.45                         | 41.40            | Total cost includes repairs amounting to \$20,254.92. |
| Greenville, Miss. ....     | 5,635                 | 1,070                     | 47,717.27           | 8.47                          | 36.95            | Total cost includes repairs amounting to \$8,171.57.  |
| Quail, Ark. ....           | 1,907                 |                           | 15,426.44           | 8.09                          |                  | All scattering repairs.                               |
| Clair, Miss. ....          | 16,661                | 1,300                     | 129,031.72          | 7.74                          | 34.15            | Total cost includes repairs amounting to \$84,627.82. |
| Cliftonwood, Miss. ....    | 29,354                | 8,060                     | 230,943.83          | 7.83                          | 28.65            | New work.                                             |
| Clarksburg, Miss. ....     | 6,443                 | 1,800                     | 55,492.10           | 8.61                          | 30.83            | Do.                                                   |
| Bed-Bedford Bend, La. .... | 1,325                 |                           | 16,641.52           | 12.56                         |                  | Work not completed.                                   |
| Bed Fork, Ark. ....        | 5,870                 |                           | 45,337.53           | 7.72                          |                  | Work in progress.                                     |

<sup>1</sup> Includes every item of field and overhead charges.

<sup>2</sup> Squares include both subaqueous and upper bank work.

<sup>3</sup> Length of effective revetment gained.

## II. LEVEES.

### (a) Upper Tensas Levee District.

*Location.*—Right bank of the river, from the Arkansas River, 402 miles below Cairo, to opposite Warrenton, Miss., 606 miles below Cairo.

*Original condition.*—By congressional act of September 25, 1850, all Government lands subject to overflow in Arkansas and Louisiana were donated to the State authorities to assist in building levees along this front. The first project adopted by the State authorities contemplated the construction of levees, with a crown width equal to their height, a base width equal to seven times their height, and a height such as to be 30 inches above the highest then known water.

With funds obtained from the sale of overflowed public lands donated to the States in 1850, a continuous line of levee was built from the Amos Bayou Mills to the lower limits of the district. These levees were practically destroyed in the great flood of 1858, and but little levee work was undertaken between 1858 and 1882.

*Previous project.*—None.

*Present project.*—The present project was adopted by the commission in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with State and local levee boards to a grade 3 feet above the deduced confined high water of 1912, and a

section having an 8-foot crown, a river slope of 3 to 1, a land slope of 3 to 1 from 8 feet below the crown, and thence a banquette, 20 feet wide for levees 10 to 12 feet high, 30 feet wide for levees 13 to 16 feet high, and 40 feet wide for levees higher than 16 feet, with a crown slope of 10 to 1.

*Operations and results prior to the present year.*—In 1882 all gaps were closed between Atherton, La., and the lower end of the district, and above Arkansas City, and by 1889 the line had been made continuous, but with very low grades and weak sections. The first extreme flood after closing all gaps occurred in 1890 and caused eight crevasses. These were all closed, but the floods of 1891, 1892, and 1893 caused, respectively, one, six, and five crevasses all of which were subsequently closed. The flood of 1897 caused three crevasses, which were promptly closed, and the flood of 1903 one crevasse. The line successfully stood the floods of 1898, 1899, 1904, 1906, 1907, 1908, 1909, and 1911. The flood of 1912 caused two crevasses in the line. These were closed and the levee strengthened and the entire line withstood the flood of 1913. The Mississippi levees withstood the flood of 1916, but two crevasses occurred in the Arkansas River levees. The work of enlarging and improving the levees had been pushed as rapidly as funds provided by the United States and the local authorities would permit. Since 1882 the United States has placed exclusive of what was placed the present year, 32,787,305 cubic yards. The length of the controlling levee line is 190.6 miles. The total expended for levee work, including construction and high-water protection work, amounts to \$7,634,232.75.

*Operations and results during the year.*—Work was continued on the enlargement to commission grade and section of the levee from station 756+35 to station 930 (530 R.), under contract with N. C. Williamson & Co., at the rate of 14.87 cents per cubic yard. Under this contract 256,985 cubic yards were placed during the year at a cost of \$33,997.83.

Work was continued on the enlargement to commission grade and section of the Arkansas River levee from station 0 to station 149 under oral agreement with John R. Scott, at the rate of 14 cents per cubic yard. Under this agreement 115,494 cubic yards were placed during the year at a cost of \$15,655.64.

Work was continued until February 28, 1917, on the enlargement to commission grade and section of the Arkansas River levee from station 149 to 500, under oral agreement with Reeve H. Hutchinson at the rate of 12 cents per cubic yard. On March 17 said Reeve H. Hutchinson was compelled, on account of financial difficulties, low price of work, and greatly increased cost of all kinds of supplies, to abandon the work. During the year 267,554 cubic yards of dirt was placed in the levee, at a cost of \$32,106.48.

On June 10, 1916, bids were opened for the closure of crevasses on the Arkansas River between stations 501+04 and 530+15 and stations 816+34 and 817+99. All bids being considered excessive were rejected and oral agreement thereupon was entered into with Massey & Wolchansky for the closure of the crevasses at the rate of 25 cents per cubic yard. On February 26, 1917, the closure of the crevasses was completed; 224,738 cubic yards of dirt having been placed at a cost of \$56,184.50.

On October 6, 1916, contract was entered into with Roach & Stansell for the enlargement to commission grade and section of the Arkansas River levee from station 530+15 to 743, at the following rates per cubic yard: Section 1, 17 cents; section 2, 21 cents; section 3, 28 cents; and section 4, 29 cents. A total of 141,083 cubic yards was placed in the levee under this contract during the year at a cost of \$21,585.69.

On September 15, 1916, bids were opened for constructing a new loop at Hagamans, La., between stations 1559+65 and 1610+05. All bids were rejected as excessive and bids then canvassed for a shorter loop, far enough back to insure a life of one year. This work was then let to Donaven & Daley for 23.4 cents per cubic yard and was completed on December 30; a total of 32,579 cubic yards having been placed at a cost of \$7,601.85. A Bucyrus drag-line excavator was then ordered for the larger work. Later in the season a number of the original bidders submitted new propositions for the construction of the loop originally advertised. The bid of Clark, Harris & Dulaney, for 19 cents, was accepted and contract entered into with them for the work. A total of 158,597 cubic yards was placed under this contract during the year at a total cost of \$27,119.09.

The average price of contract work let during the year was 23.2 cents per cubic yard.

A profile accompanies showing the actual grade that the levee line has reached, the project grade, and the elevation of recent extreme floods.

Total expenditures in this district amounted to \$194,807.18, of which amount \$2,069.93 was for new work and \$12,737.25 was for high-water work.

*Condition at end of the year.*—The total length of the levee line in this district 190.6 miles, of which 171 miles is along the Mississippi River and 19.6 miles along the Arkansas River, all of which is of sufficient height and section to protect the country behind it from moderate, and, in fact, all but the most extreme, floods. Only 10.8 miles of this line, however, is now completed to minimum grade and section, which is the minimum section that can be depended upon to safely resist the extreme floods. To complete the line to this object grade and section will require the placing of approximately 24,762,812 cubic yards, of which 20,034,377 cubic yards is required in the levees along the Mississippi and 4,728,435 cubic yards in the levees along the Arkansas.

*Local cooperation.*—The expenditures by local levee boards prior to and during the last calendar year are shown in the following table:

| Name.                                                                                                    | From 1882 to<br>Dec. 31, 1915. | During calen-<br>dar year 1916. | Total to Dec.<br>31, 1916. |
|----------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|----------------------------|
| d Fork levee district, Arkansas.....                                                                     | \$184,940.82                   | \$108,000.00                    | \$292,940.82               |
| sha levee district, Arkansas.....                                                                        | 214,034.79                     | 14,000.00                       | 228,034.79                 |
| ioot levee district, Arkansas.....                                                                       | 581,860.89                     | 40,000.00                       | 621,860.89                 |
| press Creek drainage district, Arkansas.....                                                             |                                |                                 | 709.32                     |
| e State of Louisiana, Tensas Basin levee district, and fifth<br>Louisiana levee district, Louisiana..... | 7,053,785.37                   | 229,221.98                      | 7,283,007.35               |
| Total.....                                                                                               | 8,034,621.87                   | 391,221.98                      | 8,426,553.17               |

*Proposed operations.*—Work under way on Arkansas River Levee, stations to 500, and on the Mississippi River Levees, stations 756+35 southward, and the Hagaman Loop will be continued; the new levee machine will be out in operation if funds permit, and such other work of enlargement as existing funds or future appropriations permit will be undertaken.

*Effect of improvement.*—An area of 2,500 square miles has been completely protected from overflow, and 500 square miles additional are protected from all ordinary floods.

(b) *Lower Yazoo Levee district.*

*Location.*—Left bank of river from the Coahoma-Bolivar County line, 365 miles below Cairo to mouth of the Yazoo River diversion canal, 599 miles below Cairo.

*Original condition.*—Prior to 1882 the local levee board had constructed a continuous line of levee along this front from the upper end to Eagle Lake, 24 miles above the mouth of the Yazoo River. The extreme flood of 1882 destroyed any miles of this line.

*Previous projects.*—None.

*Present project.*—The same as specified for the Upper Tensas Levee district. See II (a).)

*Operations and results prior to the present year.*—The series of floods of 1882, 1883, and 1884 prevented the successful closure of the gaps and the repair of levees. From 1885 to 1889 all gaps were closed, and the line withstood the more moderate floods of 1886, 1887, and 1888. The flood of 1890 caused seven crevasses, which were promptly closed, and the flood of 1891 caused one crevasse, which was closed. The line withstood the extreme floods of 1892 and 1893. The flood of 1897 caused five crevasses, which were closed. The floods of 1898 and 1899 were successfully held. In 1903 two crevasses occurred below Greenville, which overflowed less than half of the Yazoo Basin. These crevasses were closed, and the floods of 1904, 1906, 1907, 1908, 1909, and 1911 did not reach the line. In 1912 one crevasse occurred at Beulah, 40 miles below the head of the district, which was not closed in time to hold the first freshet of 1913. This gap was closed with a pile and rock dike in time to withstand the main 1913 flood. One crevasse occurred however at Skipwith, 55 miles above the lower end of the district, during the 1913 flood. The line withstood the record flood of 1916. In addition to closing crevasses since 1882, the commission has also enlarged and strengthened the existing line in so far as funds permitted. Since 1882 the United States has placed 28,104,006 cubic yards along its front, and has expended, including high-water protection and maintenance, \$737,363.83.

*Operations and results during the present year.*—Work was continued on the enlargement of the Lake Beulah Levee, stations 2050–2130 (404 L.), under contract with R. T. Clark & Co. Under this contract 2,219 cubic yards were placed during the year. This work merely repaired two sloughs in the levee. The unit price of this work was 21.8 cents per cubic yard. The total cost of work during the year was \$435.37.

Work was continued on the enlargement of the levee, stations 1167 to 1567+34 (495–502 L.) below Greenville, under contract with Bondurant, Callahan, Cheshire & Co., 163,156 cubic yards having been placed during the year at a total cost of \$20,530.47, bringing 15,900 feet of levee to full grade and section. The unit price of work under this contract is 14.34 cents per cubic yard.

Work was continued on the enlargement of the levee from station 1800 to 2100 (509–514 L.), below Greenville, under contract with the H. B. Blanks Levee Co., at 12.24 cents per cubic yard. During the year 318,812 cubic yards were placed at a total cost of \$35,896.99. This completed the enlargement from station 1853 to station 2097.

Work on the enlargement of the levee from station 0 to station 520 was continued with the Government levee machine throughout the year. During the year 84,724 cubic yards were placed at a field cost of \$25,343.96 (29.7 cents per cubic yard), which completed the levee down to station 123.

Work was continued under contract with Walter H. Denison for the enlargement to commission grade and section of the levee from stations 1850 to 2050 (402 L.), at 14.37 cents per cubic yard. During the year a total of 299,020 cubic yards was placed under this contract at a total cost of \$37,634.46, completing the enlargement between stations 1900 and 2050.

In September and October, 1916, contracts were entered into with the following firms for the construction of a new loop at Cottonwood, Miss., between stations 8394+80 and 8473+47 (558 L.) for the prices indicated:

| Name of firm.                                      | Section. | Stations.         | Price.         |
|----------------------------------------------------|----------|-------------------|----------------|
| R. T. Clark & Co.....                              | 1        | 8394+80–8417..... | Cents.<br>26.. |
| Do.....                                            | 2        | 8417–8436.....    | 28..           |
| W. T. & E. M. Lowrance & Co. and R. P. Harris..... | 3        | 8436–8450.....    | 40             |
| Roach & Stansell.....                              | 4        | 8450–8473+47..... | 29.7           |

Work was completed on December 30, 1916, 606,462 cubic yards having been placed at a total cost of \$189,396.40.

On January 5, 1917, hired teams were put to work on the sinking levee across Clear Creek, near Beulah, stations 2073 to 2080, and placed 2,477 cubic yards of material at a total cost of \$1,525.11, bringing the sinking section again up to grade.

The average price of contract work during the year was 31.25 cents per cubic yard.

The total expenditures in this district during the year amounted to \$357,609.58, of which amount \$344,872.33 was for new work and \$12,737.25 was for high-water protection work.

*Condition at end of the present year.*—The length of the levee line is 185.2 miles, all of which is of sufficient height and section to protect the land behind it from moderate and, in fact, all but the extreme floods. Only 14.6 miles, however, have been brought up to full project grade and section, which is the minimum that can be depended upon to resist extreme floods. To bring the line up to this grade and section will require approximately 33,773,263 cubic yards.

A profile showing the actual grade that the levee line has reached, the project grade, and the elevations of recent extreme floods accompanies this report.

*Local cooperation.*—The expenditures by the Board of Mississippi Levee Commissioners, the only local levee board interested in the maintenance of this levee line, are shown by the following statement:

|                                          |                 |
|------------------------------------------|-----------------|
| Expended from 1882 to Dec. 31, 1915..... | \$14,661,887.08 |
| Expended during calendar year 1916.....  | 580,874.13      |
| Total to Dec. 31, 1916.....              | 15,242,761.21   |

*Proposed operations.*—The enlargement from station 0 to 520 at the head of the district by operating the levee machine with hired labor will be continued. The contracts in progress: At Beulah, stations 1850 to 2050 and 2050 to 2130; at Stella, stations 1167 to 1567+33; and the Damascus to Princeton fork, stations 1800 to 2100 will be completed. Such additional enlargement work will be undertaken as available funds permit.

*Effect of the improvement.*—An area of 3,367 square miles has been protected from overflow.

*Data concerning levee yardage in third Mississippi River district.*

| Levee district.   | In system.    | Built.        | Contents, 1916.     | Built since by—        |                      | Total built since 1916. |
|-------------------|---------------|---------------|---------------------|------------------------|----------------------|-------------------------|
|                   |               |               |                     | United States.         | Local authorities.   |                         |
|                   | <i>Miles.</i> | <i>Miles.</i> | <i>Cubic yards.</i> | <i>Cubic yards.</i>    | <i>Cubic yards.</i>  | <i>Cubic yards.</i>     |
| Lower Yazoo.....  | 206.30        | 185.2         | 51,836,527          | <sup>1</sup> 1,371,564 | <sup>2</sup> 896,423 | 2,267,987               |
| Upper Tensas..... | 192.0         | 190.6         | 48,726,244          | 1,070,219              | 1,527,964            | 2,598,183               |

| Levee district.   | Lost or abandoned during year. | Contents, 1917.     | Required to complete. | Estimated final contents. | Per cent now built. | Approximate area protected. |
|-------------------|--------------------------------|---------------------|-----------------------|---------------------------|---------------------|-----------------------------|
|                   | <i>Cubic yards.</i>            | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cubic yards.</i>       |                     | <i>Square miles.</i>        |
| Lower Yazoo.....  | 833,000                        | 53,271,514          | 33,773,263            | 87,044,777                | 61.2                | 3,367                       |
| Upper Tensas..... | 220,000                        | 51,104,427          | 24,762,817            | 75,867,244                | 67.3                | 2,500                       |

<sup>1</sup> 422,670 cubic yards Ashbrook Dike not included.

<sup>2</sup> 263,387 cubic yards of sublevees not included.

NOTE.—Arkansas River levees from Red Fork to the Lincoln-Jefferson County line not included in above table.

|                                                              |              |
|--------------------------------------------------------------|--------------|
|                                                              | Cubic yards. |
| Estimated yardage in place (built by local authorities)..... | 2,958,047    |
| Estimated yardage required to complete.....                  | 4,539,872    |

*Cost of levees in third district built by machines.*

| Machine and location.                              | Mobilization. | Clearing. | Drainage. | Plowing. | Operation.  | Repairs.   | Dressing. | Scdding. |
|----------------------------------------------------|---------------|-----------|-----------|----------|-------------|------------|-----------|----------|
| Levee machine No. 1, at upper end of district..... |               | \$589.18  | \$489.79  | \$129.15 | \$16,006.35 | \$4,427.78 | \$676.50  | \$79.15  |
| Maparte and Bourbon Ashbrook Dike.....             | \$2,612.10    | 197.55    | 51.32     | .....    | 11,505.40   | 705.99     | 1,634.31  | 79.40    |

| Machine and location.                              | Care.      | Surveys. | Depreciation. <sup>1</sup> | Overhead.  | Total cost. | Yardage handled. | Cost per cubic yard.  |
|----------------------------------------------------|------------|----------|----------------------------|------------|-------------|------------------|-----------------------|
| Levee machine No. 1, at upper end of district..... | \$2,264.26 | .....    | \$4,560.00                 | \$2,946.06 | \$32,168.12 | 81,724           | <i>Cents.</i><br>26.3 |
| Maparte and Bourbon Ashbrook Dike.....             | 2,033.07   | \$216.00 | 16,517.20                  | 1,526.13   | 37,078.47   | 381,850          | 10.2                  |

Depreciation of plant is fixed at 20 per cent per annum.

### III. SURVEYS.

*(a) Revetment surveys.*

Hydrographic surveys were made over all revetments, between August 8 and October 7, 1916. The information obtained from these surveys is incorporated in the several paragraphs relating to condition of revetments.

In these surveys the original base lines, run out in order to accurately locate the mats placed, and certain fixed ranges, usually 200 feet apart, were retraced. Soundings were taken on the ranges thus located; shore lines were run above and below the revetments as far as active caving was encountered, and soundings were taken on ranges 1,000 to 1,500 feet apart within these reaches.

(b) *Reach and bank line surveys.*

Surveys were also made in the following reaches: Dennis (372 L.), Waxhaw (393 L.), Riverton (400 L.), Caulks Neck (409 R.), Arkansas City (439 R.), Millers Bend (459 L.), Lake Jackson (511 L.), Stack Island Chute (540 L.), Promised Land (546 L.), Cottonwood (558 L.), Brunswick (573 L.), Henderson (573 R.), and Millikens Bend (583 R.).

These surveys indicate that caving is in progress in all reaches surveyed and that new levee loops or revetments will be necessary in the immediate or near future at the following points:

Princeton (514 L.), stations 2097-2123.

Haggaman (542 R.), stations 1560-1614.

Shiloh (555 L.), stations 8420-8470.

Angle near Brunswick (574 L.), stations 5200-5260.

Henderson (573 R.), stations 2840-3000.

Millikens Bend (583 R.), stations 3076-3149; (585 R.), stations 3231-3301.

Near Delta, La. (598 R.), stations 4195-4210.

In these surveys the bank line was meandered, and where necessary soundings were taken on ranges 1,000 to 1,500 feet apart.

#### IV. PLANT.

The following items of plant were added during the year:

The steam tug *Sidney C.*, and the gasoline launch *Carroll* were purchased from private parties. A barge specially designed for laying concrete revetment was constructed and machinery installed by day labor. Machinery for two concrete mixer plants was purchased and installed on barges already on hand.

Twelve creosoted wood material barges are being constructed, nine of which have been completed and put in service. The remaining three have been creosoted and framed complete ready for erection at the United States fleet. Burned derrick No. 1309 was repaired and rebuilt on barge No. 071.

Two additional floating concrete mixing plants, one concrete mixing and chuting tower barge, and one additional barge for laying concrete revetment have been authorized and work on them has commenced, to be continued by hired labor at the United States fleet.

A shop building was constructed on shore, and the machine, blacksmith, and tin shops moved into same.

General repairs were made to plant during the year and plant was cared for during the lay-up season.

The total expenditures were as follows:

|                       |              |
|-----------------------|--------------|
| New plant.....        | \$122,782.61 |
| Repairs to plant..... | 37,601.00    |
| Care of plant.....    | 12,814.91    |
| Total.....            | 173,198.56   |

The following table shows the cost of new plant built or purchased during the year, June 1, 1916, to May 31, 1917:

| Name or number.                            | Cost.      | How obtained.                                                                            |
|--------------------------------------------|------------|------------------------------------------------------------------------------------------|
| g Sydney C.....                            | \$7,730.00 | Purchased from private parties.                                                          |
| so line launch Carroll.....                | 2,400.00   | Do.                                                                                      |
| crete mat barge No. 1608.....              | 18,968.05  | Built by hired labor at United States fleet.                                             |
| errick No. 071.....                        | 3,132.72   | Burned derrick No. 1309 rebuilt on barge 071.                                            |
| crete mixers and derricks:<br>No. 072..... | 7,343.18   | Machinery and bins installed at United States fleet on mat barge No. 072. Not completed. |
| No. 1709.....                              | 481.49     | Machinery and bins installed at United States fleet on mat barge No. 1709.               |
| er and tower No. 1509.....                 | 8,499.09   | Machinery, tower, and bins installed at United States fleet on mat barge No. 1509.       |
| draulic grader No. 1014.....               | 19,684.96  | Cabin built and machinery installed at United States fleet on barge No. 1014.            |
| w shop building.....                       | 8,053.67   | Built by hired labor on United States property. Not complete.                            |
| new barges.....                            | 46,128.78  | Built by hired labor at United States fleet. Not complete.                               |
| kiffs.....                                 | 360.67     | Built by hired labor at United States fleet.                                             |
| Total.....                                 | 122,782.61 |                                                                                          |

The following table shows the cost of repair work done on plant during the year June 1, 1916, to May 31, 1917:

| Name or number.                   | Cost.      | Work done.                                                                                                                                                                                    |
|-----------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ammers:<br>Control.....           | \$4,647.36 | Docked; new floor timbers in bottom, 60 per cent new planking on bottom; new transom, cylinder timbers, and wheel; machinery thoroughly overhauled; minor repairs made during year as needed. |
| Arthur Hider.....                 | 1,920.45   | Repairs to both fantails; new plank sheer; repairs to wheel; machinery overhauled; minor repairs made during the year as needed.                                                              |
| H. St. L. Coppee.....             | 2,980.20   | Renewed portions of plank sheer; new breechings and stacks; new flues in main boilers; machinery overhauled; minor repairs made during year as needed.                                        |
| Issaquena.....                    | 2,652.47   | New rudder stocks, rudders repaired; new pillow blocks; hull repaired; machinery overhauled; minor repairs made during year as needed.                                                        |
| gs:<br>Sydney C.....              | 1,652.42   | Steam capstan installed; docked; hull sand blasted and coated with coal-tar pitch; new cylinder castings; machinery overhauled; new furnace; minor repairs made during year as needed.        |
| White Water.....                  | 1,802.38   | 2 new sheets in top strake; corroded frames renewed and resurfaced; machinery overhauled; minor repairs made during year as needed.                                                           |
| Boaz.....                         | 474.56     | Repairs to coal bin, pipes, yawls, and minor repairs during the year as needed.                                                                                                               |
| Parker.....                       | 106.92     | Work on hull, and docking; dismantling; minor repairs to keep afloat.                                                                                                                         |
| draulic graders:<br>No. 1011..... | 1,466.02   | Repairs to and repainting cabin; overhauling main pumps; minor repairs during year as needed.                                                                                                 |
| No. 1012.....                     | 1,406.01   |                                                                                                                                                                                               |
| No. 1013.....                     | 426.26     |                                                                                                                                                                                               |
| rick boats:<br>No. 083.....       | 13.60      | Minor repairs to machinery.                                                                                                                                                                   |
| No. 579.....                      | 51.75      | Repairing deck, piping, wells, etc.                                                                                                                                                           |
| No. 1109.....                     | 365.75     | Docked; repairing and calking hull; building lockers; work on machinery.                                                                                                                      |
| No. 1311.....                     | 329.76     | Do.                                                                                                                                                                                           |
| No. 1503.....                     | 108.06     | Repairing machinery, derrick irons, shaft, etc.                                                                                                                                               |
| No. 1504.....                     | 269.80     | Calking; work on machinery, derrick, etc.; minor repairs during year as needed.                                                                                                               |
| painter shop No. 079.....         | 99.55      | Repairs to boiler and machinery; calking; minor repairs during year as needed.                                                                                                                |
| chine shop No. 222.....           | 1,455.87   | Raised and docked; hull sheathed to water line. Machinery replaced; minor repairs made during year as needed.                                                                                 |
| arter boats:<br>No. 155.....      | 452.11     | Docked; hulls repaired and calked; deck on guards; cabins screens and roofs repaired; new pits for ranges, and piping overhauled.                                                             |
| No. 156.....                      | 496.57     |                                                                                                                                                                                               |
| No. 157.....                      | 381.24     |                                                                                                                                                                                               |
| No. 159.....                      | 417.71     |                                                                                                                                                                                               |
| No. 1107.....                     | 11.83      | Repairs, calking, etc.                                                                                                                                                                        |
| No. 1201.....                     | 122.66     | Replacing broken glass; screening; building lockers.                                                                                                                                          |

| Name or number.              | Cost.     | Work done.                                                                                                                              |
|------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Quarter boats—Continued.     |           |                                                                                                                                         |
| No. 1202.....                | \$9.75    | Stovepipe on range.                                                                                                                     |
| No. 1307.....                | 12.32     | Minor repairs.                                                                                                                          |
| No. 1308.....                | 3.60      | Building screen doors.                                                                                                                  |
| No. 1513.....                | 36.55     | Repairing doors; screening; work on pumps.                                                                                              |
| No. 1607.....                | 15.74     | Repairing screens.                                                                                                                      |
| No. 1010.....                | 944.45    | Docked; hulls repaired and calked all over; cabins repaired and painted; forcastle upper deck screened; all screens and doors repaired. |
| No. 31.....                  | 799.43    | Repairs to roof.                                                                                                                        |
| No. 1108.....                | 18.78     | Repairing doors, windows, roof, and cabin.                                                                                              |
| No. 1308.....                | 145.15    | Patching deck.                                                                                                                          |
| No. 583.....                 | 1.90      |                                                                                                                                         |
| Mat boats:                   |           |                                                                                                                                         |
| No. 089.....                 | 24.05     | Minor repairs.                                                                                                                          |
| No. 0810.....                | 31.17     | Do.                                                                                                                                     |
| No. 1134.....                | 393.38    | Repairs to deck; calking; lengthening skids.                                                                                            |
| No. 1135.....                | 418.56    | Do.                                                                                                                                     |
| No. 1136.....                | 1,179.88  | Renewing main and apron decks complete with creosote lumber; repairing stanchions and skids.                                            |
| No. 1137.....                | 1,317.54  |                                                                                                                                         |
| Barges:                      |           |                                                                                                                                         |
| No. 07X.....                 | 53.16     | Renewing timber heads; calking sides.                                                                                                   |
| No. 073.....                 | 86.27     | Do.                                                                                                                                     |
| No. 077.....                 | 373.36    | Building hatch; repairing deck, timber heads, and calking sides.                                                                        |
| No. 078.....                 | 59.50     | Renewing timber heads and calking sides.                                                                                                |
| No. 082.....                 | 200.10    | Docking; renewing timber heads; calking sides.                                                                                          |
| No. 084.....                 | 45.10     | Docked; sides calked; planing repaired.                                                                                                 |
| No. 6 (line).....            | 98.24     | Calking sides, putting in timber heads, calking, repairing hull deck, etc.                                                              |
| No. 103.....                 | 4.65      | Minor repairs and calking.                                                                                                              |
| No. 104.....                 | 46.65     | Do.                                                                                                                                     |
| No. 106.....                 | 38.50     | Timber heads; repaired capstan; calked; minor repairs.                                                                                  |
| No. 108.....                 | 5.90      | Minor repairs.                                                                                                                          |
| No. 564.....                 | 29.13     | Putting in timber heads and hatch covers.                                                                                               |
| No. 568.....                 | 66.46     | Repairs to deck; calking; renewing timber heads.                                                                                        |
| No. 572.....                 | 270.22    | Repairing rakes, spuds, and building horses.                                                                                            |
| No. 575.....                 | 43.06     | Repairing deck and calking sides.                                                                                                       |
| No. 579.....                 | 38.45     | Do.                                                                                                                                     |
| No. 581.....                 | 442.98    | Docked; changed to brush-loading barge; repaired bottom and deck; calked all over; spuds installed.                                     |
| No. 584.....                 | 491.01    | Work on deck.                                                                                                                           |
| No. 583.....                 | 1.40      | Repairs to deck and sides; calked all over; renewing timber heads.                                                                      |
| No. 582.....                 | 409.61    | Building hatch covers.                                                                                                                  |
| No. 585.....                 | 6.31      | Docked; bottom and sides repaired and calked; renewed apron and timber heads.                                                           |
| No. 586.....                 | 250.28    | Deck repaired; hatches built.                                                                                                           |
| No. 587.....                 | 192.31    | Docked; sides and bottom repaired and calked; deck and timber heads repaired.                                                           |
| No. 589.....                 | 397.53    | Calking sides and rake.                                                                                                                 |
| No. 1101.....                | 8.78      | Minor repairs.                                                                                                                          |
| No. 1102.....                | 3.60      | Installing gravel bins, calking, etc.                                                                                                   |
| No. 1103 (scow).....         | 84.79     | Repairing gravel bins; calking.                                                                                                         |
| No. 1105 (scow).....         | 10.20     | Sides calked.                                                                                                                           |
| No. 1106.....                | 12.00     | Docked; sand blasted and coated with pitch.                                                                                             |
| No. 1204.....                | 391.23    | Do.                                                                                                                                     |
| No. 1207.....                | 210.51    | Gravel bins installed; sand blasted; painted.                                                                                           |
| No. 1209.....                | 50.53     | Docked; sand blasted and coated with pitch.                                                                                             |
| No. 1301.....                | 134.50    | Gravel bins built; deck and sides scraped and painted.                                                                                  |
| No. 1303.....                | 132.17    | Scraped and painted deck and sides.                                                                                                     |
| No. 1304.....                | 75.99     | Docked; sand blasted and coated with pitch.                                                                                             |
| No. 1305.....                | 199.91    | Do.                                                                                                                                     |
| No. 1306.....                | 184.52    | Docked; hole in rake repaired.                                                                                                          |
| No. 1310.....                | 48.18     | Docked; bottom repaired and calked.                                                                                                     |
| No. 1401.....                | 67.23     |                                                                                                                                         |
| No. 1403 (scow).....         | 11.20     | Minor repairs and calking.                                                                                                              |
| No. 1404 (scow).....         | 8.00      |                                                                                                                                         |
| No. 1502.....                | 2.00      |                                                                                                                                         |
| No. 1503.....                | 45.58     |                                                                                                                                         |
| No. 1505.....                | 109.57    | Installing traveler and track and converting into mooring barges for use in sinking subaqueous concrete mats.                           |
| No. 1507.....                | 149.92    | Minor repairs and calking.                                                                                                              |
| No. 1510.....                | 107.99    |                                                                                                                                         |
| No. 1512.....                | 5.19      |                                                                                                                                         |
| No. 1206.....                | 57.01     | Installing bins to convert into gravel barges.                                                                                          |
| No. 1208.....                | 57.01     |                                                                                                                                         |
| No. 1604.....                | 57.04     |                                                                                                                                         |
| Dry dock, No. 1015.....      | 35.30     | Renewing blocks; minor repairs.                                                                                                         |
| Gasoline launch, Chicot..... | 1,989.97  | Installing new engine; overhauling hull and interior fitting.                                                                           |
| Gas boats:                   |           |                                                                                                                                         |
| No. 2.....                   | 10.60     | Minor repairs to engine.                                                                                                                |
| No. 3.....                   | 74.60     | Repairing hull, engine, and rudder.                                                                                                     |
| Carroll.....                 | 152.10    | Repairs to engine and hull.                                                                                                             |
| Total.....                   | 37,601.04 |                                                                                                                                         |

## V. HIGH-WATER WORK.

To guard against possible danger to the levee system from high water arrangements were made early in April for the distribution of plant and assistants throughout the district so as to render prompt assistance in case of trouble. A system of patrols was also inaugurated for the purpose of guarding the line during day and night for a few days previous to and following the crest of the flood.

No trouble was experienced at any point in the district except on the new Shubbrook Dike, constructed during the past season, where considerable damage was done at the lower end of the dike.

J. R. SLATTERY,

*Major, Corps of Engineers, U. S. A.*

## Abstract of contracts in force for the year ended June 30, 1917.

| Contractor.                                       | Date of—       |                  | Date fixed for—            |                           | Amount and character of work or materials.                                    |                                     |                                                                                                     |                                  |                         | Unit price.      | Per cent completed. |
|---------------------------------------------------|----------------|------------------|----------------------------|---------------------------|-------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------|-------------------------|------------------|---------------------|
|                                                   | Contract.      | Approval.        | Commencement.              | Completion.               | Yardage.                                                                      | Stations.                           | Miles.                                                                                              | Levee.                           |                         |                  |                     |
| <i>Levee work in Lower Yazoo levee district.</i>  |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  |                         |                  |                     |
| Walter H. Denison.....                            | June 15, 1915  | June 23, 1915    | July 13, 1915              | Dec. 1, 1916 <sup>1</sup> | 743,000                                                                       | 1850-2050                           | 402 L.                                                                                              | Lake Beulah.....                 | <i>Cents.</i><br>14.37  | 93               |                     |
| R. T. Clark & Co.....                             | Nov. 13, 1914  | Nov. 27, 1914    | Dec. 17, 1914              | .....do. <sup>1</sup>     | 139,116                                                                       | 2090-2130                           | 404 L.                                                                                              | Beulah Crevasse.....             | 21.8                    | 71               |                     |
| Bondurant, Callahan, Cheshire & Co.               | Dec. 26, 1914  | Jan. 7, 1915     | Jan. 24, 1915              | .....do. <sup>1</sup>     | 1,249,000                                                                     | 1167-1567+33                        | 495-502 L.                                                                                          | Wayside-Stella.....              | 14.34                   | 58               |                     |
| The H. B. Blanks Levee Co.....                    | Jan. 11, 1915  | Jan. 18, 1915    | Feb. 5, 1915               | .....do. <sup>1</sup>     | 725,000                                                                       | 1800-2100                           | 506-514 L.                                                                                          | Damascus-Princeton               | 12.25                   | 81               |                     |
| <i>Levee work in Upper Tensas levee district.</i> |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  |                         |                  |                     |
| Roach & Stansell.....                             | Oct. 6, 1916   | Oct. 18, 1916    | Nov. 3, 1916               | Dec. 1, 1919              | 680,000                                                                       | 530+15-743<br>530+15-592<br>592-640 | Arkansas River enlargement.<br>Section 1.....<br>Section 2.....<br>Section 3.....<br>Section 4..... | .....<br>.....<br>.....<br>..... | .....<br>17<br>21<br>28 | 29               |                     |
| H. C. Williamson & Co.....                        | June 29, 1915  | July 10, 1915    | July 22, 1915              | Dec. 1, 1916 <sup>1</sup> | 484,989                                                                       | 690-743                             | 530 R.                                                                                              | Opossum-Wilson Point.....        | 14.87                   | 96               |                     |
| Clark, Harris & Dulaney.....                      | Jan. 15, 1917  | Jan. 26, 1917    | Feb. 13, 1917              | Dec. 1, 1917              | 528,000                                                                       | 756+35-930<br>1559+65-1610+05       | 342 R.                                                                                              | Hagaman new levee.               | 19                      | 45               |                     |
| <i>Willows for revetment work.</i>                |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  |                         |                  |                     |
| Tennessee Contracting Co.....                     | Jan. 15, 1915  | Jan. 13, 1915    | Indeterminate              | .....                     | Cutting privilege on lands owned or controlled by the contractor.             |                                     |                                                                                                     |                                  |                         |                  |                     |
|                                                   |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  | <i>Cord.</i><br>2 10    | ( <sup>2</sup> ) |                     |
| <i>Riprap stone.</i>                              |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  |                         |                  |                     |
| Foster & Creighton Co.....                        | May 19, 1915   | June 3, 1915     | When notified <sup>3</sup> | .....                     | 25,000 short tons, more or less, at quarries in Alabama.....                  |                                     |                                                                                                     |                                  |                         |                  |                     |
| United States Stone Co.....                       | Sept. 21, 1916 | Oct. 6, 1916     | .....do. <sup>3</sup>      | .....                     | 20,000 short tons of stone on river bank at Arkansas City, Ark.....           |                                     |                                                                                                     |                                  |                         |                  |                     |
|                                                   |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  | 4.35<br>477.5           | 45<br>90         |                     |
| <i>Lease of land.</i>                             |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  |                         |                  |                     |
| The Y. & M. V. R. Co.....                         | Nov. 2, 1914   | ( <sup>4</sup> ) | .....                      | .....                     | Lease of strip of land bordering third district repair yard, Vicksburg, Miss. |                                     |                                                                                                     |                                  |                         |                  |                     |
|                                                   |                |                  |                            |                           |                                                                               |                                     |                                                                                                     |                                  | ( <sup>6</sup> )        | .....            |                     |

<sup>1</sup> Time limit waived.<sup>2</sup> Per cord.<sup>3</sup> Indeterminate.<sup>4</sup> Per ton.<sup>5</sup> Not subject to approval.<sup>6</sup> \$374 for first year; \$24 per annum thereafter.

## FINANCIAL STATEMENTS—THIRD DISTRICT.

*appropriation for maintenance and improvement of existing river and harbor works, act Oct. 2, 1914.*

## REPAIRS TO EXISTING WORKS AND STONE.

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1916, balance unexpended           | \$9,787.45 |
| Reimbursed by other engineer districts     | 315.66     |
|                                            | <hr/>      |
| June 30, 1917, expended during fiscal year | 10,103.11  |
|                                            | <hr/>      |
|                                            | 10,103.11  |

## UPPER TENSAS LEVEE DISTRICT.

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1916, balance unexpended           | 231,654.31 |
| June 30, 1917, expended during fiscal year | 51,635.86  |
|                                            | <hr/>      |
| July 1, 1917, balance unexpended           | 180,018.45 |
| July 1, 1917, outstanding liabilities      | 15,093.53  |
|                                            | <hr/>      |
| July 1, 1917, balance available            | 164,924.92 |

## LOWER YAZOO LEVEE DISTRICT.

|                                                       |            |
|-------------------------------------------------------|------------|
| July 1, 1916, balance unexpended                      | 166,387.97 |
| Collection of overpayment made in January, 1916       | 1.00       |
|                                                       | <hr/>      |
| June 30, 1917, expended during fiscal year            | 166,388.97 |
|                                                       | <hr/>      |
|                                                       | 54,941.35  |
|                                                       | <hr/>      |
| July 1, 1917, balance unexpended                      | 111,447.62 |
| July 1, 1917, amount covered by uncompleted contracts | 111,447.62 |

*appropriation for maintenance and improvement of existing river and harbor works, act Mar. 4, 1915.*

## LAKE BOLIVAR FRONT, MISS.

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1916, balance unexpended           | \$7,853.00 |
| June 30, 1917, expended during fiscal year | 7,853.00   |

## ASHBROOK NECK, MISS.

|                                                       |             |
|-------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended                      | 37,941.74   |
| June 30, 1917, expended during fiscal year            | 11,166.91   |
|                                                       | <hr/>       |
| July 1, 1917, balance unexpended                      | 26,774.83   |
| July 1, 1917, outstanding liabilities                 | \$17,044.11 |
| July 1, 1917, amount covered by uncompleted contracts | 8,327.89    |
|                                                       | <hr/>       |
|                                                       | 25,372.00   |
|                                                       | <hr/>       |
| July 1, 1917, balance available                       | 1,402.83    |

## PANTHER FOREST, ARK.

|                                                 |           |
|-------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                | 42,980.21 |
| Collection of overpayment made in January, 1916 | .20       |
|                                                 | <hr/>     |
|                                                 | 42,980.41 |
|                                                 | <hr/>     |
| June 30, 1917, expended during fiscal year      | 42,980.41 |

## GREENVILLE, MISS.

|                                                 |           |
|-------------------------------------------------|-----------|
| July 1, 1916, balance unexpended                | 39,614.75 |
| Collection of overpayment made in January, 1916 | 1.00      |
|                                                 | <hr/>     |
|                                                 | 39,615.75 |
|                                                 | <hr/>     |
| June 30, 1917, expended during fiscal year      | 39,615.75 |

## GRAND LAKE, ARK.

|                                                 |             |
|-------------------------------------------------|-------------|
| July 1, 1916, balance unexpended                | \$3, 686. 9 |
| Collection of overpayment made in January, 1916 | 1. 4        |
|                                                 | 3, 688. 4   |
| June 30, 1917, expended during fiscal year      | 3, 688. 4   |

## FITLERS BEND, MISS.

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1916, balance unexpended           | 50, 948. 7 |
| June 30, 1917, expended during fiscal year | 50, 948. 7 |

## REPAIRS TO EXISTING WORKS AND STONE.

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1916, balance unexpended           | 25, 000. 0 |
| June 30, 1917, expended during fiscal year | 25, 000. 0 |

## EXPERIMENTAL REVETMENT.

|                                            |        |
|--------------------------------------------|--------|
| July 1, 1916, balance unexpended           | 194. 8 |
| June 30, 1917, expended during fiscal year | 194. 8 |

## ASHBROOK DIKE, MISS.

|                                            |                          |
|--------------------------------------------|--------------------------|
| July 1, 1916, balance unexpended           | 106, 499. 6              |
| June 30, 1917, expended during fiscal year | <sup>1</sup> 106, 499. 6 |

## UPPER TENSAS LEVEE DISTRICT.

|                                                       |             |
|-------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended                      | 125, 236. 9 |
| Receipts from sales                                   | 6, 300. 0   |
|                                                       | 131, 536. 9 |
| June 30, 1917, expended during fiscal year            | 97, 035. 4  |
| July 1, 1917, balance unexpended                      | 34, 501. 5  |
| July 1, 1917, amount covered by uncompleted contracts | 11, 207. 5  |
|                                                       | 23, 294. 0  |
| July 1, 1917, balance available                       | 23, 294. 0  |

## LOWER YAZOO LEVEE DISTRICT.

|                                                       |            |
|-------------------------------------------------------|------------|
| July 1, 1916, balance unexpended                      | 71, 716. 5 |
| Receipts from sales                                   | 6, 300. 0  |
|                                                       | 78, 016. 5 |
| June 30, 1917, expended during fiscal year            | 70, 396. 0 |
| July 1, 1917, balance unexpended                      | 7, 620. 5  |
| July 1, 1917, amount covered by uncompleted contracts | 7, 620. 5  |

## SURVEYS, THIRD DISTRICT.

|                                            |           |
|--------------------------------------------|-----------|
| July 1, 1916, balance unexpended           | 4, 964. 9 |
| June 30, 1917, expended during fiscal year | 2, 416. 0 |
|                                            | 2, 548. 9 |
| July 1, 1917, balance unexpended           | 2, 548. 9 |
| July 1, 1917, outstanding liabilities      | 487. 4    |
|                                            | 2, 061. 4 |
| July 1, 1917, balance available            | 2, 061. 4 |

<sup>1</sup> On account of transfer of a steel barge built from this allotment to the fourth Mississippi River district and by authority of the Chief of Engineers (E. D. 71814/248), the expenditures for Ashbrook Dike were decreased \$21,075.90 and the expenditures for Atchafalaya levee district correspondingly increased. With this adjustment, the net expenditure should be \$85,423.73.

## PLANT, THIRD DISTRICT.

|                                             |            |
|---------------------------------------------|------------|
| July 1, 1916, balance unexpended            | \$9,841.86 |
| Receipts from sales                         | 2,125.55   |
| Collection of overpayment made in May, 1916 | .50        |
|                                             | <hr/>      |
| June 30, 1917, expended during fiscal year  | 11,967.91  |
|                                             | <hr/>      |

*Appropriation for improving Yazoo River and tributaries, Miss.*

## YAZOO RIVER, AT MOUTH.

|                                                                                                                                         |             |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended                                                                                                        | \$14,722.52 |
| Oct. 9, 1916, transferred to Engineer Department (Vicksburg, Miss., district), under provision of river and harbor act of July 27, 1916 | 14,722.52   |

*Appropriation for Mississippi River, river and harbor act July 27, 1916.*

## LAKE BOLIVAR FRONT, MISS.

|                                                      |             |
|------------------------------------------------------|-------------|
| Aug. 14, 1916, approved allotment                    | \$90,000.00 |
| June 30, 1917, expended during fiscal year           | \$26,137.55 |
| Transferred to "Repairs to existing works and stone" | 60,000.00   |
|                                                      | <hr/>       |
|                                                      | 86,137.55   |
| July 1, 1917, balance unexpended and available       | 3,862.45    |

## ASHBROOK NECK, MISS.

|                                                |            |
|------------------------------------------------|------------|
| Aug. 14, 1916, approved allotment              | 60,000.00  |
| June 30, 1917, expended during fiscal year     | \$1,654.38 |
| Transferred to "Upper Tensas levee district"   | 20,000.00  |
|                                                | <hr/>      |
|                                                | 21,654.38  |
| July 1, 1917, balance unexpended and available | 38,345.62  |

## PANTHER FOREST, ARK.

|                                            |           |
|--------------------------------------------|-----------|
| Aug. 14, 1916, approved allotment          | 70,000.00 |
| June 30, 1917, expended during fiscal year | 43,376.06 |
| July 1, 1917, balance unexpended           | 26,623.94 |
| July 1, 1917, outstanding liabilities      | 4,380.53  |
| July 1, 1917, balance available            | 22,243.41 |

## FITLERS BEND, MISS.

|                                                |          |
|------------------------------------------------|----------|
| Aug. 14, 1916, approved allotment              | 9,000.00 |
| Reimbursed by other engineer districts         | 192.26   |
|                                                | <hr/>    |
| June 30, 1917, expended during fiscal year     | 9,192.26 |
|                                                | <hr/>    |
| July 1, 1917, balance unexpended and available | 192.26   |

## REPAIRS TO EXISTING WORKS AND STONE.

|                                            |             |
|--------------------------------------------|-------------|
| Aug. 14, 1916, approved allotment          | 60,000.00   |
| Transferred from "Lake Bolivar front"      | 60,000.00   |
|                                            | <hr/>       |
| June 30, 1917, expended during fiscal year | \$54,033.83 |
| Transferred to "Plant, third district"     | 20,000.00   |
|                                            | <hr/>       |
|                                            | 74,033.83   |
| July 1, 1917, balance unexpended           | 45,966.17   |
| July 1, 1917, outstanding liabilities      | 13,897.32   |
| July 1, 1917, balance available            | 32,068.85   |

## ASHBROOK DIKE, MISS.

|                                              |             |              |
|----------------------------------------------|-------------|--------------|
| Aug. 14, 1916, approved allotment            |             | \$232,000.00 |
| June 30, 1917, expended during fiscal year   | \$97,673.13 |              |
| Transferred to "Upper Tensas Levee District" | 20,000.00   |              |
|                                              |             | 117,673.13   |
| July 1, 1917, balance unexpended             |             | 114,326.83   |
| July 1, 1917, outstanding liabilities        |             | 31,283.83    |
| July 1, 1917, balance available              |             | 83,043.00    |

## UPPER TENSAS LEVEE DISTRICT.

|                                                       |             |            |
|-------------------------------------------------------|-------------|------------|
| Aug. 14, 1916, approved allotment                     |             | 373,000.00 |
| Receipts from sales                                   |             | 7.00       |
| Transferred from "Ashbrook Dike, Miss."               |             | 20,000.00  |
| Transferred from "Ashbrook Neck, Miss."               |             | 20,000.00  |
| Transferred from "Cottonwood, Miss."                  |             | 20,000.00  |
|                                                       |             | 433,000.70 |
| June 30, 1917, expended during fiscal year            | \$80,551.70 |            |
| Transferred to "Lower Yazoo levee district"           | 49,000.00   |            |
|                                                       |             | 129,551.70 |
| July 1, 1917, balance unexpended                      |             | 303,449.00 |
| July 1, 1917, outstanding liabilities                 | 57,566.15   |            |
| July 1, 1917, amount covered by uncompleted contracts | 206,851.72  |            |
|                                                       |             | 264,417.85 |
| July 1, 1917, balance available                       |             | 39,031.15  |

## LOWER YAZOO LEVEE DISTRICT.

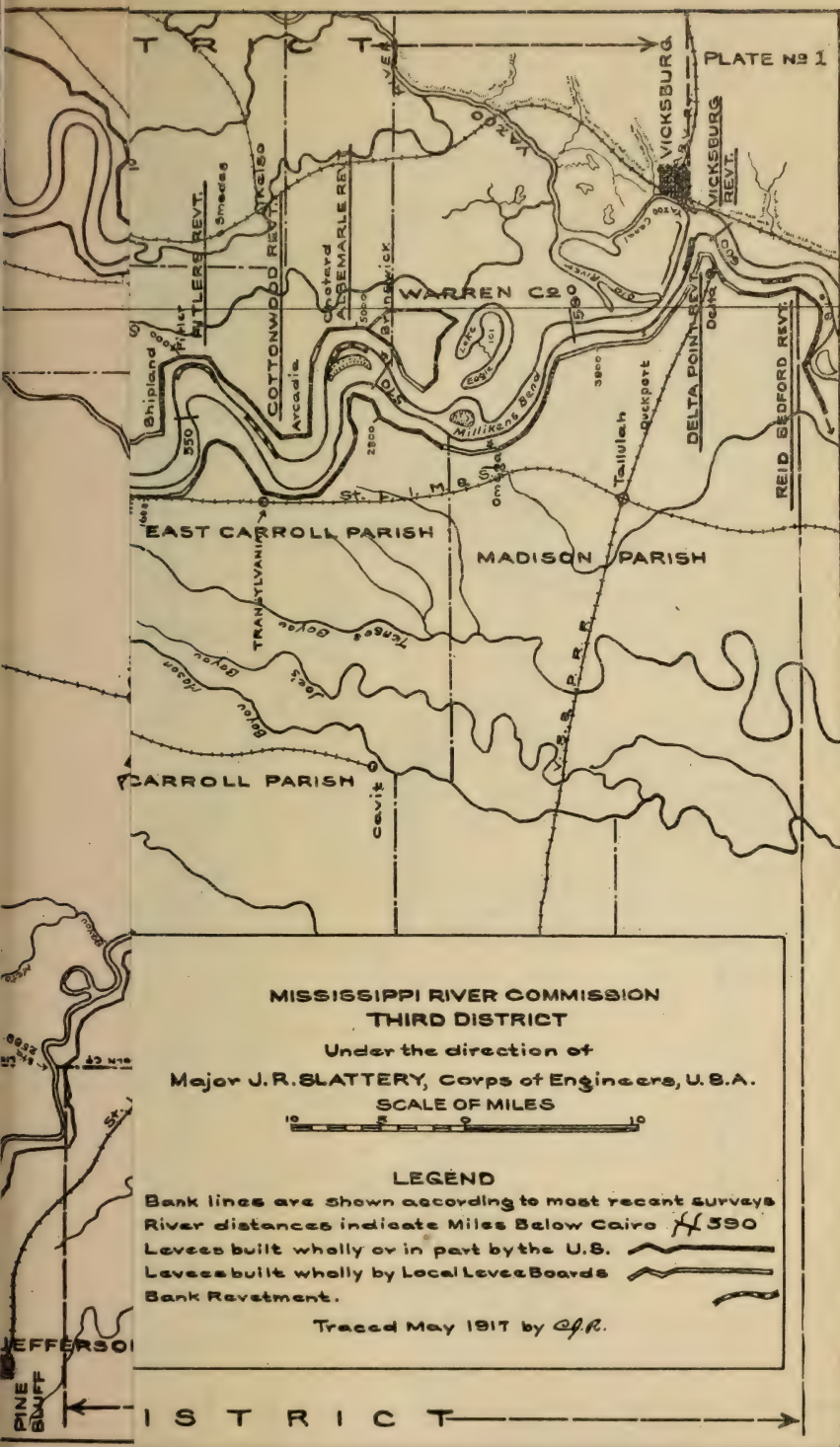
|                                                       |            |            |
|-------------------------------------------------------|------------|------------|
| Aug. 14, 1916, approved allotment                     |            | 300,000.00 |
| Transferred from "Upper Tensas levee district"        |            | 49,000.00  |
|                                                       |            | 349,000.00 |
| June 30, 1917, expended during fiscal year            |            | 244,379.93 |
| July 1, 1917, balance unexpended                      |            | 104,620.00 |
| July 1, 1917, outstanding liabilities                 | \$2,387.43 |            |
| July 1, 1917, amount covered by uncompleted contracts | 21,073.94  |            |
|                                                       |            | 23,461.37  |
| July 1, 1917, balance available                       |            | 81,158.63  |

## SURVEYS, THIRD DISTRICT.

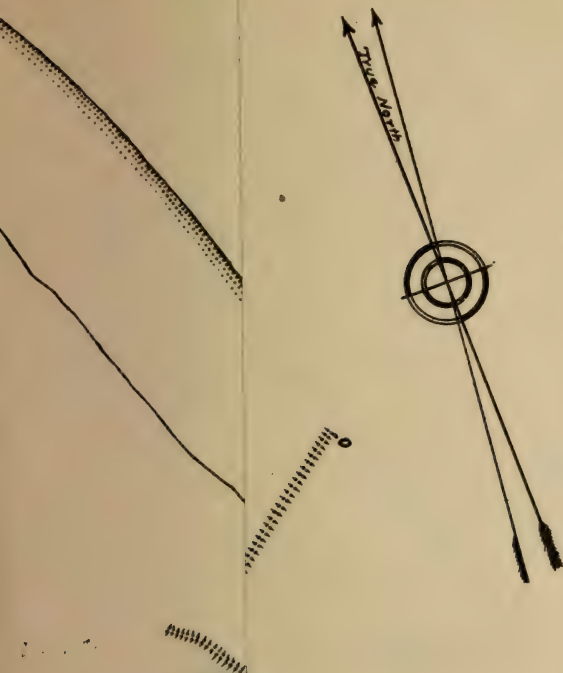
|                                                |  |          |
|------------------------------------------------|--|----------|
| Aug. 14, 1916, approved allotment              |  | 5,000.00 |
| July 1, 1917, balance unexpended and available |  | 5,000.00 |

## PLANT, THIRD DISTRICT.

|                                                        |             |            |
|--------------------------------------------------------|-------------|------------|
| Aug. 14, 1916, approved allotment                      |             | 266,000.00 |
| Receipts from sales                                    |             | 127.13     |
| Transferred from "Repairs to existing works and stone" |             | 20,000.00  |
| Reimbursed by other engineer districts                 |             | 316.70     |
|                                                        |             | 286,443.83 |
| June 30, 1917, expended during fiscal year             |             | 211,614.93 |
| July 1, 1917, balance unexpended                       |             | 74,828.83  |
| July 1, 1917, outstanding liabilities                  | \$62,542.26 |            |
| July 1, 1917, amount covered by uncompleted contracts  | 24.00       |            |
|                                                        |             | 62,566.26  |
| July 1, 1917, balance available                        |             | 12,262.57  |

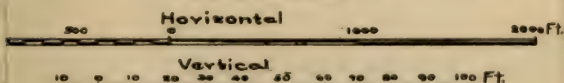






K. ARK.




MISSISSIPPI RIVER COMMISSION  
Third District  
**RED FORK REVETMENT**  
ARKANSAS RIVER  
Prepared under the direction of  
for J. R. SLATTERY, Corps of Engineers, U.S.A.  
SCALES OF FEET



Soundings reduced to 139.3 ft. Memphis Datum  
Survey of Feb. 1917 *C.R.* Chief of Party  
Traced May 1917 by *C.R.*



# LEGEND

-  Indicates Concrete Mats built & sunk during Fiscal Year.
-  " Fascine Mats.
-  " Concrete Bank Paving.

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1917.

*J.R. Slattery*  
Major Corps of Engineers, U.S. Army

MISSISSIPPI RIVER COMMISSION  
Third District  
**RED FORK REVETMENT**  
ARKANSAS RIVER  
Prepared under the direction of  
Major J.R. SLATTERY, Corps of Engineers, U.S.A.  
SCALES OF FEET

Horizontal 0 200 400 600 800 1000 2000 Ft.

Vertical 0 10 20 30 40 50 60 70 80 90 100 Ft.

Soundings reduced to 159.3 ft. Memphis Datum  
Survey of Feb. 1917 *C.R. Chist* of Party  
Traced May 1917 by *C.R.*



VICKSBURG, M

To accompany Annual  
Fiscal Year ending in

*J. R. S. L.*

Major, Corps of I

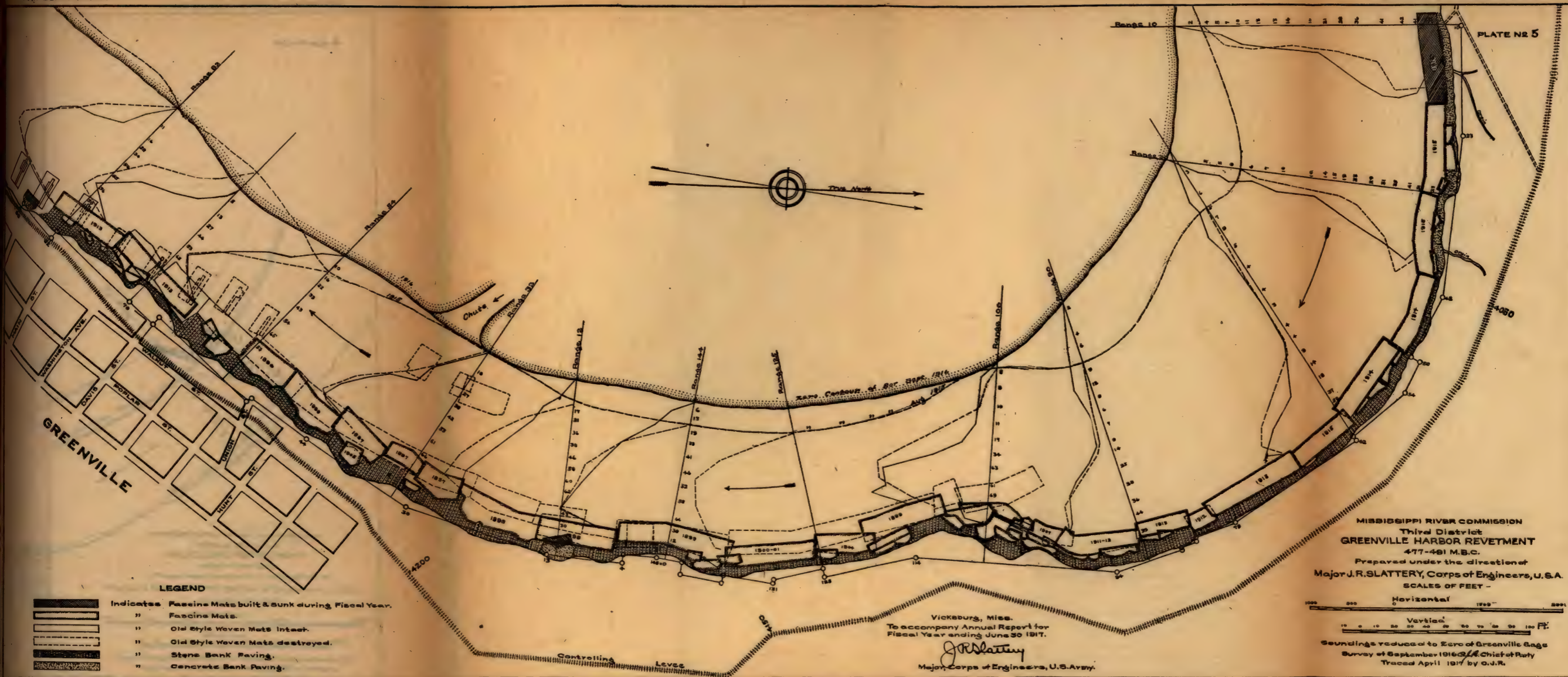
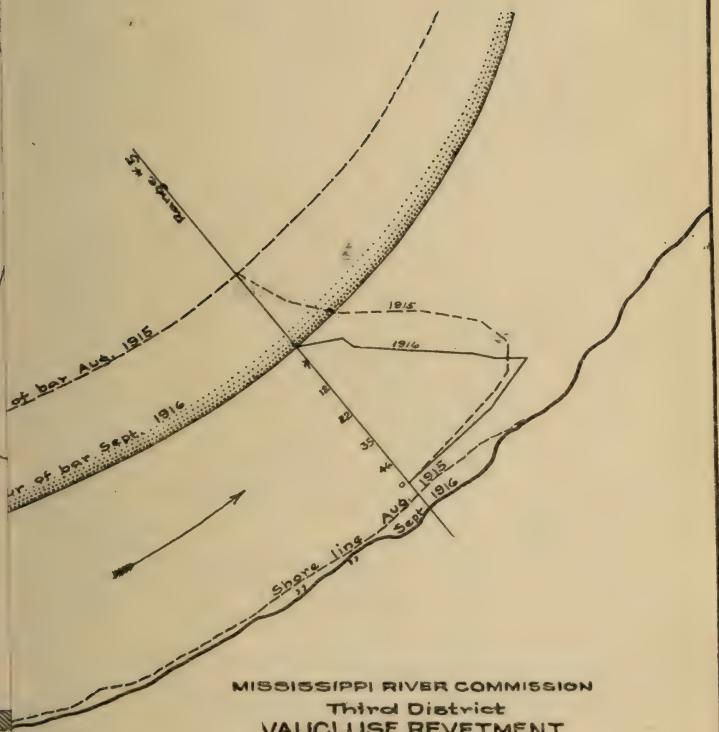


PLATE NO 6



MISSISSIPPI RIVER COMMISSION

Third District  
VAUCLOSE REVETMENT

488-488 M.B.C.

Prepared under the direction of

Major J. R. SLATTERY, Corps of Engineers, U.S.A.

SCALES OF FEET

Horizontal 0 500 1000 2000 Ft.

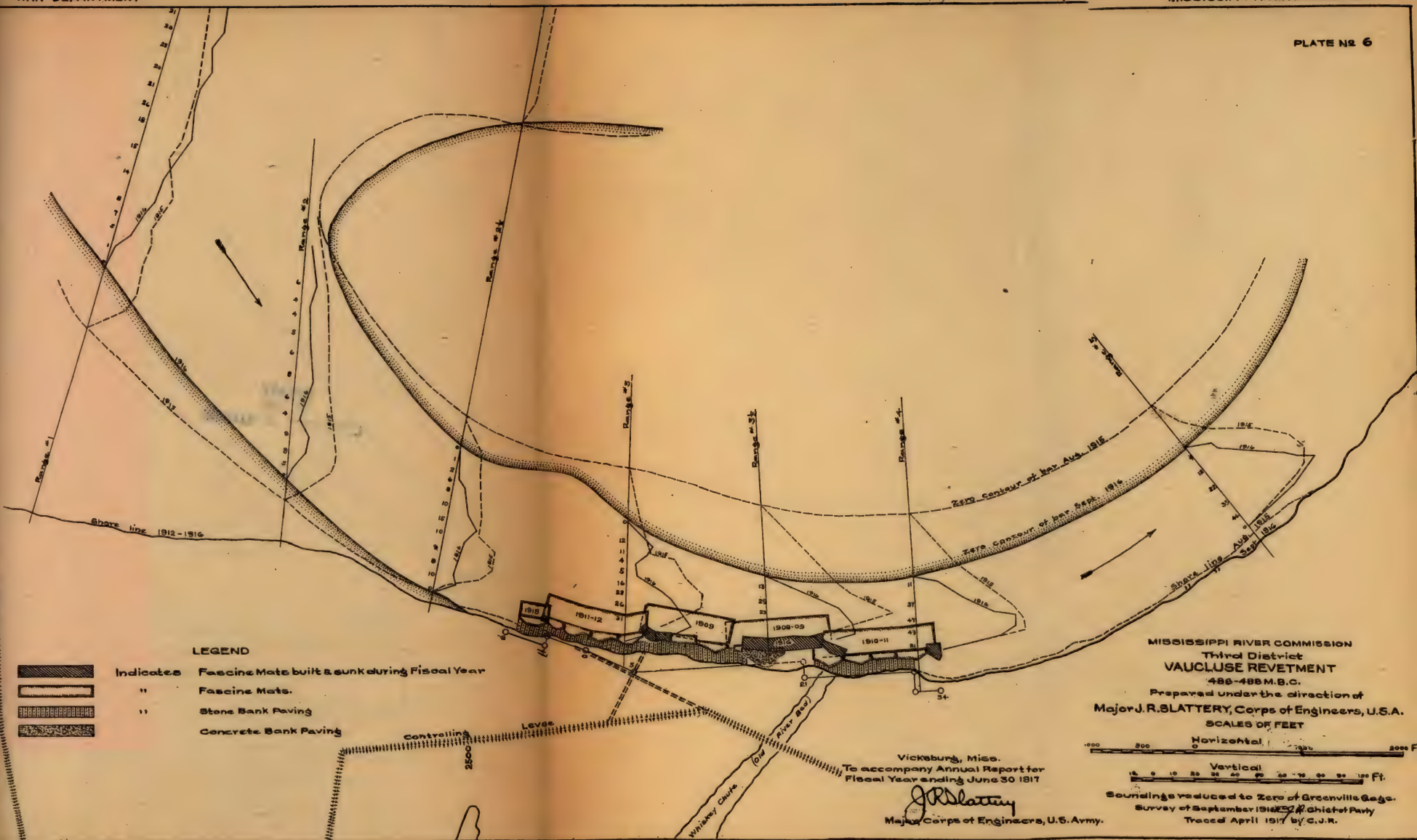
Vertical 0 10 20 30 40 50 60 70 80 90 100 Ft.

Soundings reduced to Zero of Greenville Gage.

Survey of September 1916 by R. Ghiet of Party

Traced April 1917 by C. J. R.

re, U.S. Army.



287-3

287-3

287-3

287-3

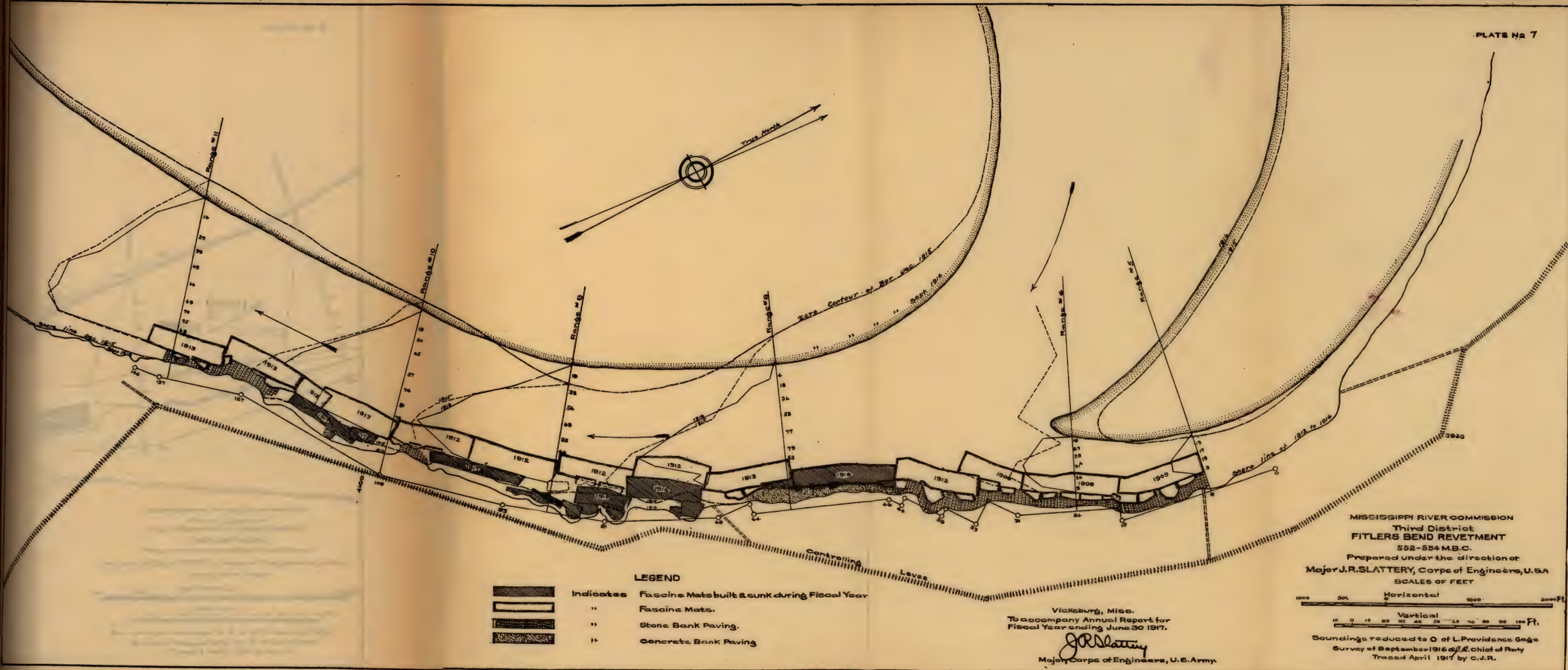




PLATE NR 8

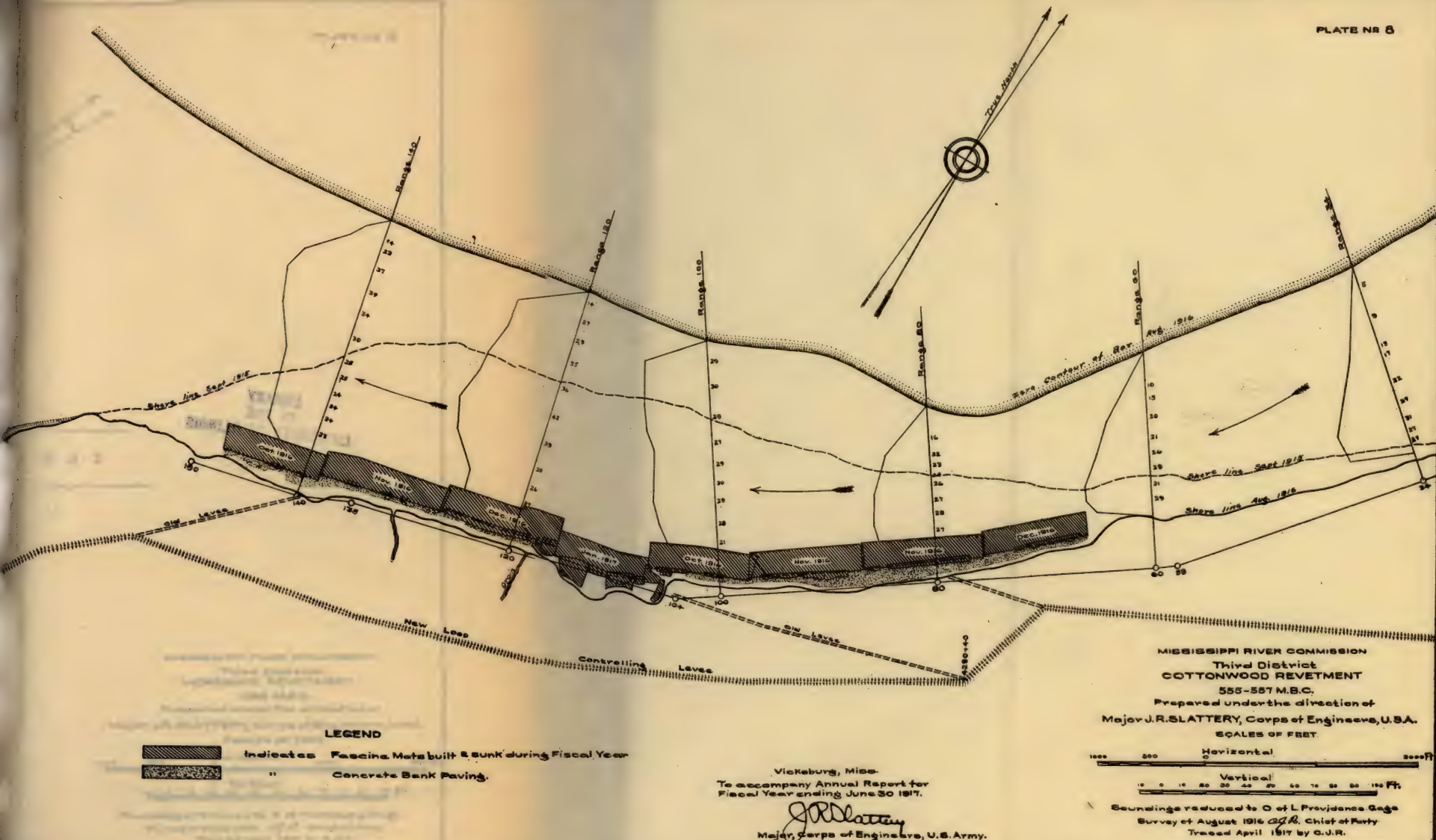


PLATE NO 9



N A L

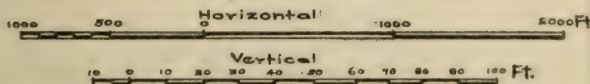
MISSISSIPPI RIVER COMMISSION

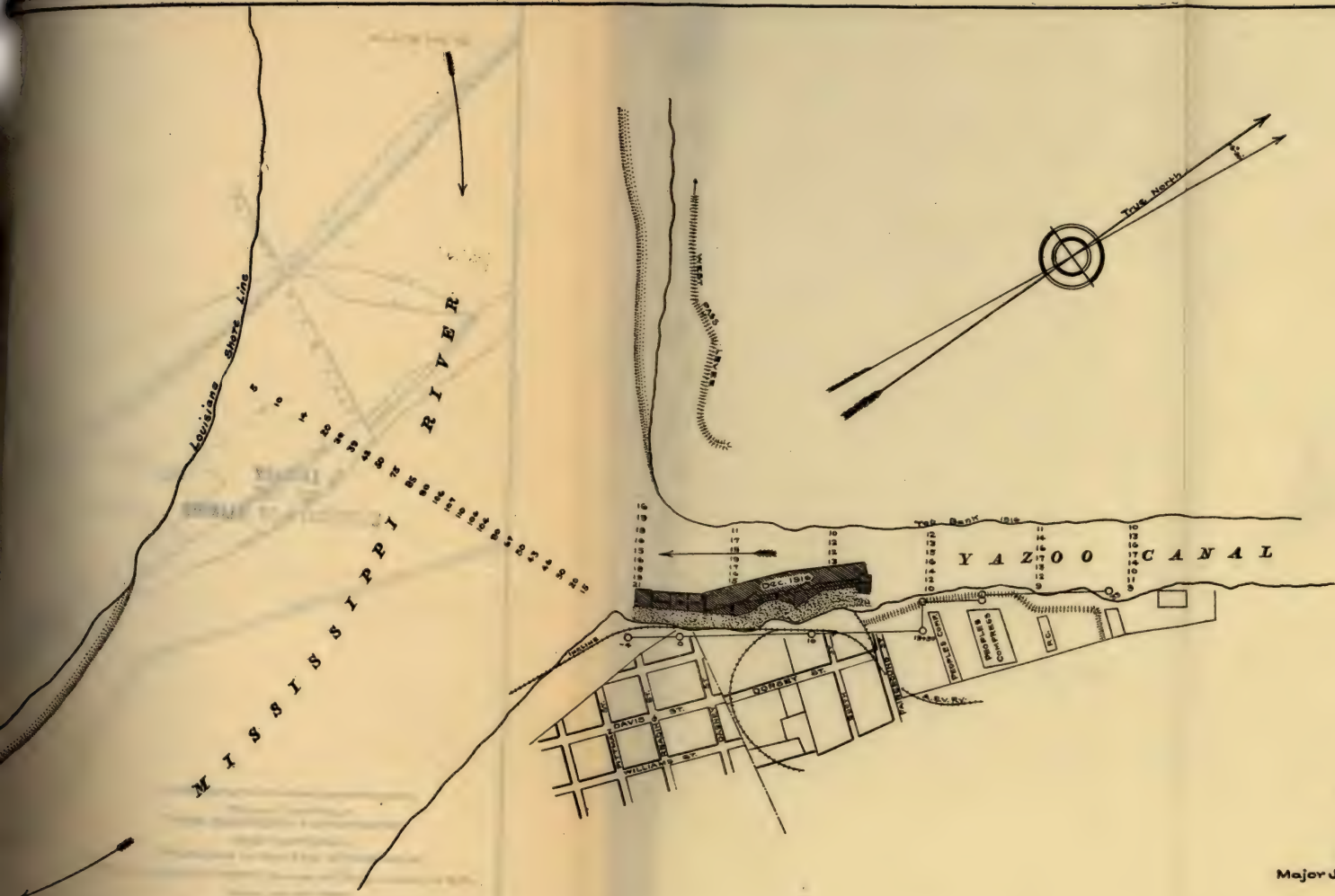
Third District  
VICKSBURG REVETMENT

599 M.B.C.



Prepared under the direction of  
Major J. R. SLATTERY, Corps of Engineers, U.S.A.

SCALES OF FEET

Soundings reduced to 3' of Vicksburg Gage  
Survey of Sept. 1916 *C. R.* Chief of Party  
Traced April 1917 by C. J. R.



LEGEND

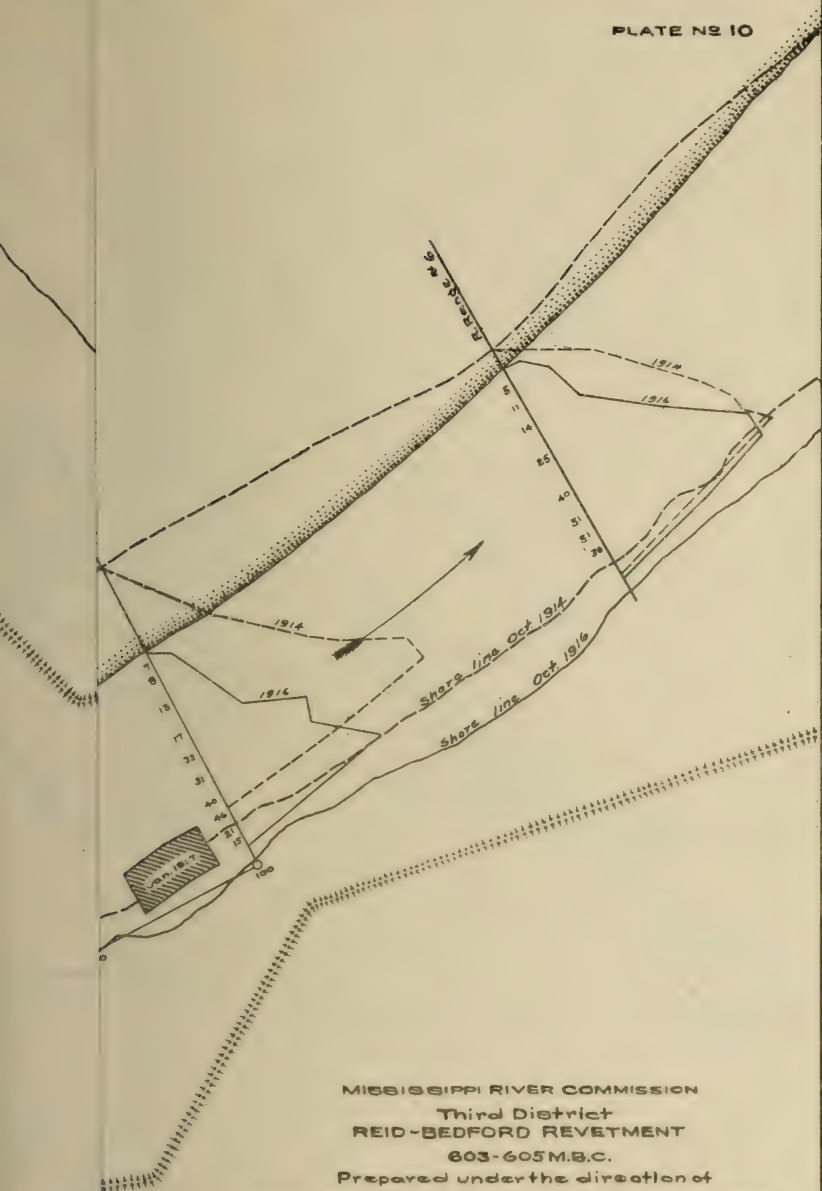
-  Indicates Flexible Concrete Mats built & sunk during Fiscal Year.
-  " Concrete Bank Paving.

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1917.

*J.R. Slattery*  
Major, Corps of Engineers, U.S. Army.

MISSISSIPPI RIVER COMMISSION  
Third District  
VICKSBURG REVETMENT  
599 M.B.C.  
Prepared under the direction of  
Major J.R. SLATTERY, Corps of Engineers, U.S.A.  
SCALES OF FEET  
Horizontal: 1000 200 0 1000 2000 Ft.  
Vertical: 10 0 10 20 30 40 50 60 70 80 100 Ft.  
Soundings reduced to 3' of Vicksburg Gage  
Survey of Sept. 1916 *C.R. Chief of Party*  
Traced April 1917 by C.J.R.

PLATE NO 10



MISSISSIPPI RIVER COMMISSION

Third District

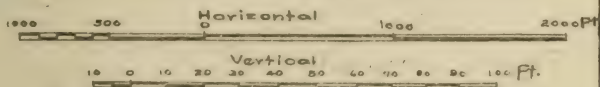
REID-BEDFORD REVETMENT

603-605 M.B.C.

Prepared under the direction of

Major J.R. SLATTERY, Corps of Engineers, U.S.A.

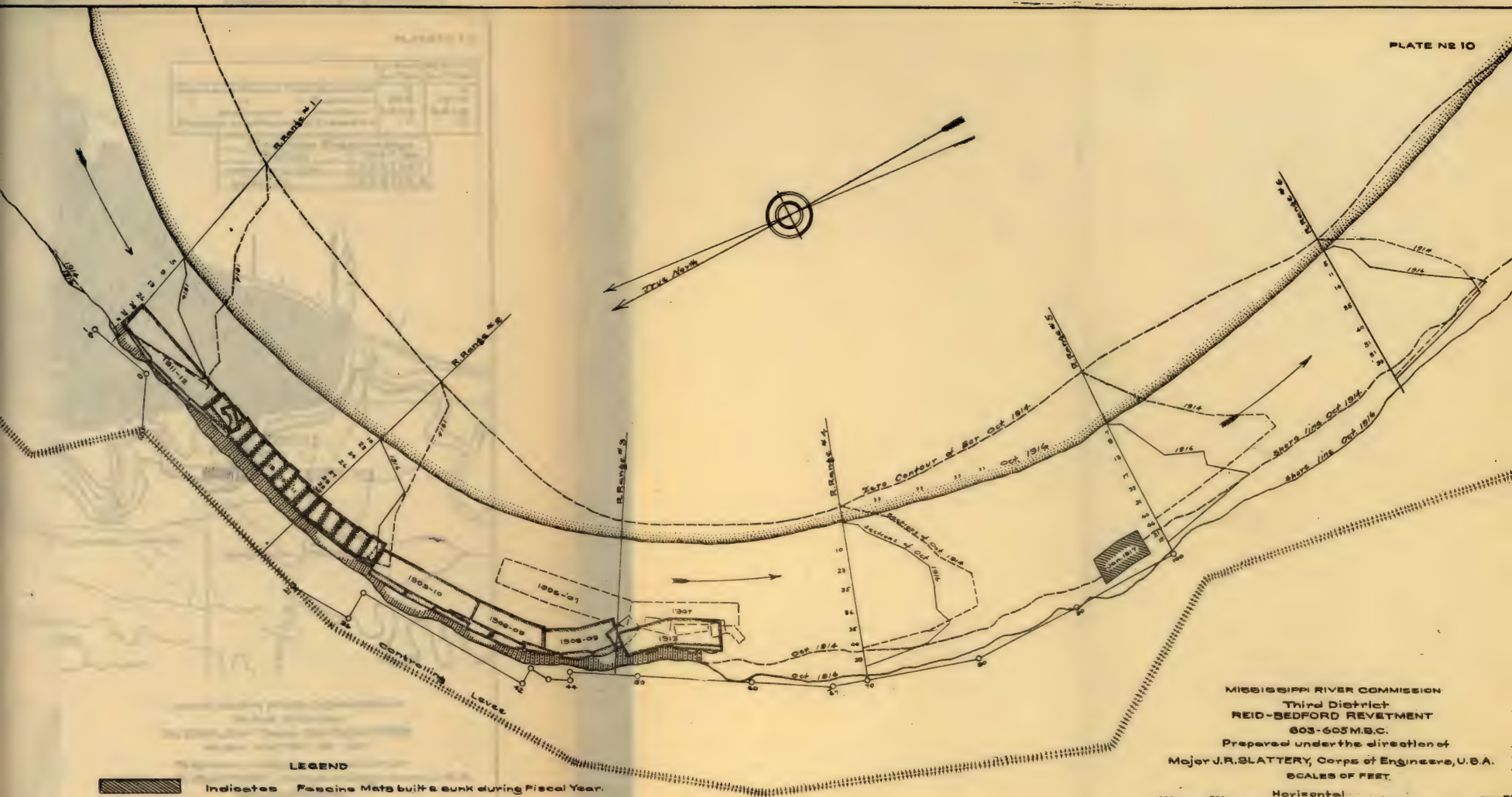
SCALES OF FEET.



Soundings reduced to 3 ft. Vicksburg Gage.

Survey at Oct. 1916 C.R. Chief of Party.

Traced April 1917 by O.J.R.



Vicksburg, Miss.  
 To accompany Annual Report for  
 Fiscal Year ending June 30 1917.

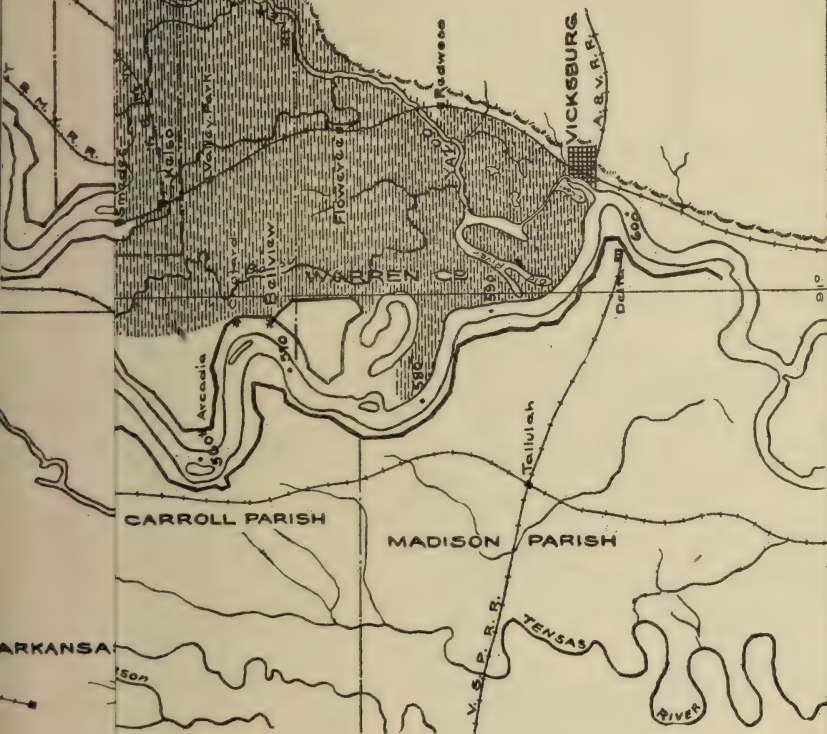
*J.R. Slattery*  
 Major, Corps of Engineers, U.S. Army.

Soundings reduced to St. Vicksburg Gage.  
 Survey of Oct. 1916 C.R. Chief of Party.  
 Traced April 1917 by C.J.R.

PLATE NO 11

|                                 | Lt. Bank<br>Sq. Miles | Rt. Bank<br>Sq. Miles |
|---------------------------------|-----------------------|-----------------------|
| Area overflowed from Crevasses  | 0                     | 0                     |
| " " " Backwater                 | 808                   | 372                   |
| " " " Overflow                  | 2559                  | 2628                  |
| Percent overflowed by Crevasses | 0                     | 0                     |

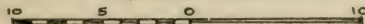
| Maximum Gage Readings |      |      |
|-----------------------|------|------|
| Station               | 1916 | 1917 |
| Arkansas City         | 56.4 | 52.1 |
| Vicksburg             | 53.9 | 49.8 |



MISSISSIPPI RIVER COMMISSION  
Third District  
OVERFLOW FROM BACKWATER  
HIGH WATER OF 1917

Prepared under the direction of  
Major J. R. SLATTERY, Corps of Engineers, U.S.A.

SCALE OF MILES



Compiled from Maps and Records on file in this Office.

Overflow from water flowing around

Amos Bayou Levee. -----

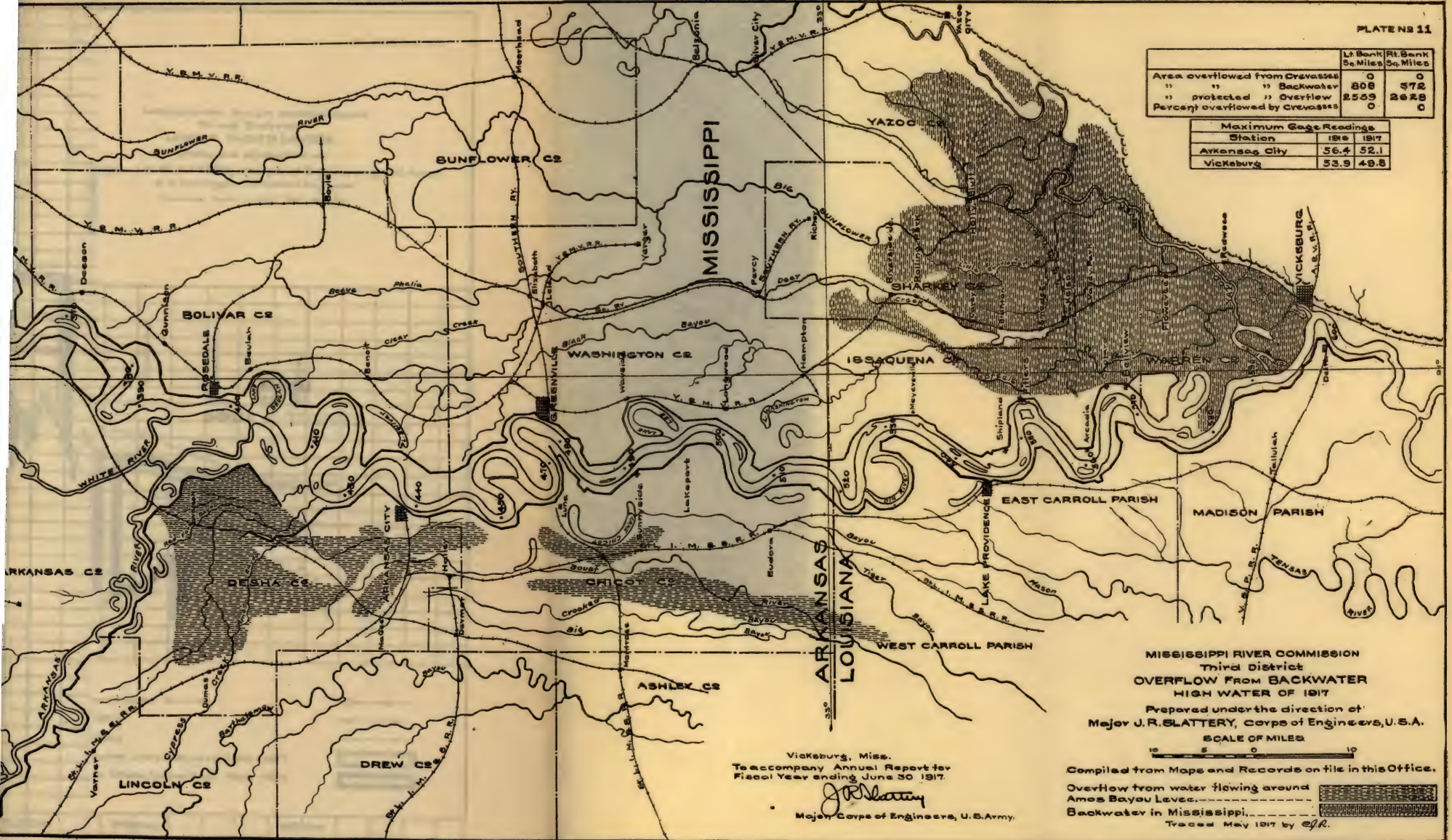
Backwater in Mississippi. -----

Traced May 1917 by efr.

PLATE NS 11

|                                | Lt. Bank<br>Sq. Miles | Rt. Bank<br>Sq. Miles |
|--------------------------------|-----------------------|-----------------------|
| Area overflowed from Crevasse  | 0                     | 0                     |
| " " Backwater                  | 808                   | 572                   |
| " " protected " Overflow       | 2559                  | 2628                  |
| Percent overflowed by Crevasse | 0                     | 0                     |

| Maximum Gage Readings |      |      |
|-----------------------|------|------|
| Station               | 1886 | 1917 |
| Arkansas City         | 56.4 | 52.1 |
| Vicksburg             | 53.9 | 49.8 |



MISSISSIPPI RIVER COMMISSION  
Third District  
OVERFLOW FROM BACKWATER  
HIGH WATER OF 1917  
Prepared under the direction of  
Major J.R. SLATTERY, Corps of Engineers, U.S.A.  
SCALE OF MILES  
10 5 0 10

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1917.  
*J.R. Slattery*  
Major, Corps of Engineers, U.S. Army.

Compiled from Maps and Records on file in this Office.  
Overflow from water flowing around  
Amos Bayou Levee.  
Backwater in Mississippi.  
Traced May 1917 by EGR.

MISSISSIPPI RIVER COMMISSION  
Third District  
LOWER YAZOO LEVEES

Under the direction of

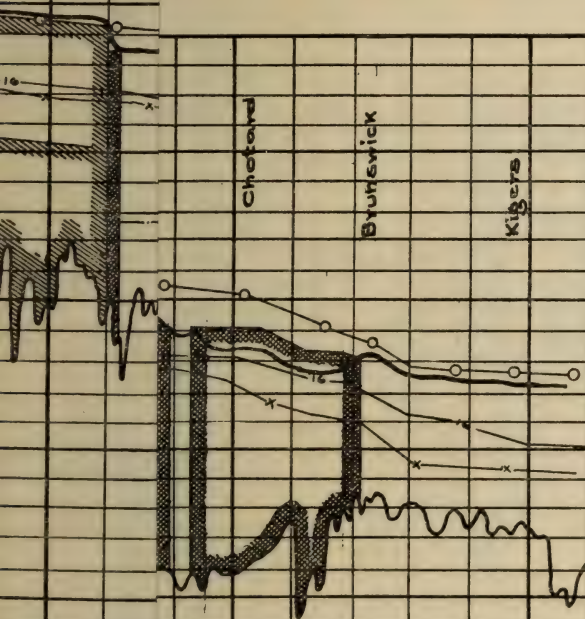
Major J. R. SLATTERY, Corps of Engineers, U.S. Army.

E. C. Tollinger, Assistant Engineer

Traced April - 1917 by C. J. R.

Leota

Palmato



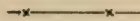
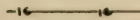
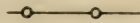
Commission Grade

1916

1912

by the United States 1916-1917.

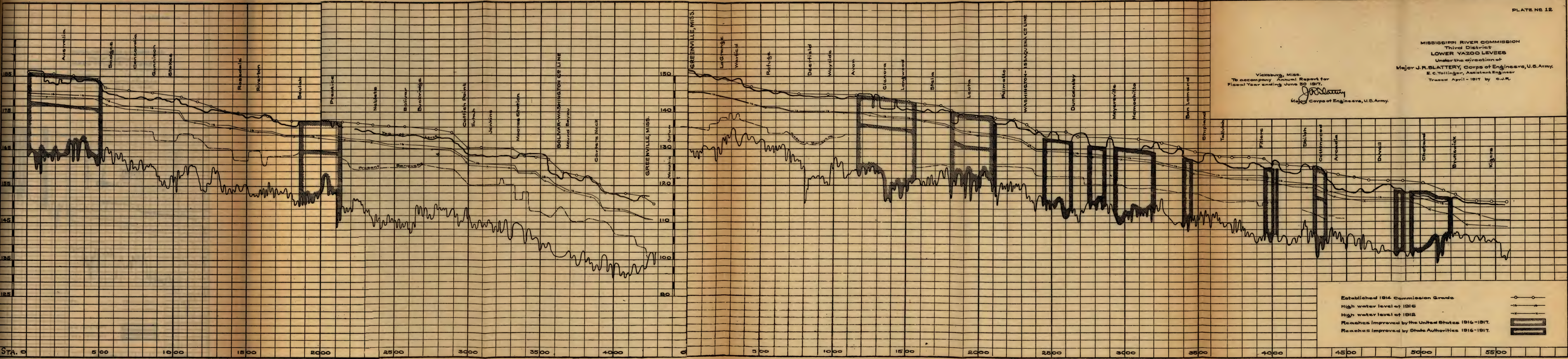
by State Authorities 1916-1917.



2000

5000

5500



MISSISSIPPI RIVER COMMISSION  
Third District  
LOWER YAZOO LEVEES  
Under the direction of  
Major J. R. SLATTERY, Corps of Engineers, U.S. Army.  
E. C. Tollinger, Assistant Engineer  
Traced April - 1917 by C. J. R.

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1917.  
J. R. Slattery  
Major Corps of Engineers, U.S. Army.

MISSISSIPPI RIVER COMMISSION

Third District

UPPER TENNESAS LEVEES

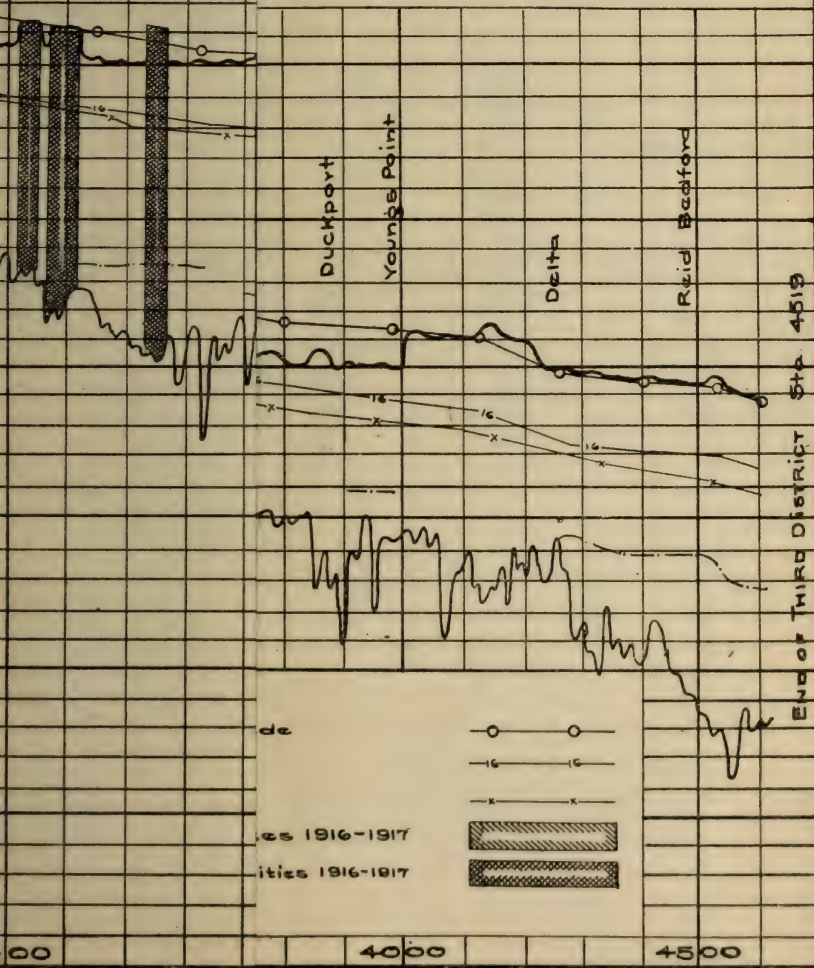
prepared under the direction of

BATTERY, Corps of Engineers, U.S. Army.

E. C. Tollinger, Assistant Engineer

Traced April 1917 by C. J. R.

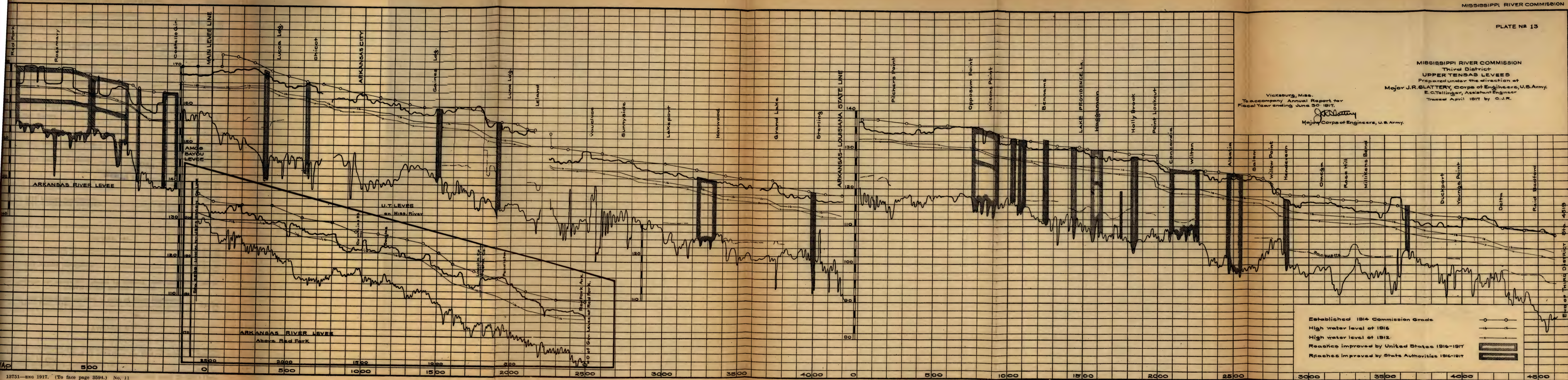
Bennett



MISSISSIPPI RIVER COMMISSION  
Third District  
UPPER TENNESSEAN LEVEES  
Prepared under the direction of  
Major J.R. SLATTERY, Corps of Engineers, U.S. Army.  
E.C. Tollinger, Assistant Engineer  
Traced April 1917 by C.J.R.

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30, 1917.

*J.R. Slattery*  
Major, Corps of Engineers, U.S. Army.



## COTTONWOOD, MISS.

|                                              |                  |
|----------------------------------------------|------------------|
| Aug. 14, 1916, approved allotment            | \$240,000.00     |
| Receipts from sales                          | 10.00            |
|                                              | <hr/> 240,010.00 |
| June 30, 1917, expended during fiscal year   | \$214,376.28     |
| Transferred to "Upper Tensas levee district" | 20,000.00        |
|                                              | <hr/> 234,376.28 |
| July 1, 1917, balance unexpended             | 5,633.72         |
| July 1, 1917, outstanding liabilities        | 2,978.92         |
|                                              | <hr/> 2,654.80   |
| July 1, 1917, balance available              | 2,654.80         |

## VICKSBURG, MISS.

|                                                                            |                  |
|----------------------------------------------------------------------------|------------------|
| Aug. 14, 1916, approved allotment                                          | 100,000.00       |
| Reimbursed by other engineer districts and by United States Weather Bureau | 562.12           |
|                                                                            | <hr/> 100,562.12 |
| June 30, 1917, expended during fiscal year                                 | 70,521.48        |
|                                                                            | <hr/> 30,040.64  |
| July 1, 1917, balance unexpended                                           | 30,040.64        |
| July 1, 1917, outstanding liabilities                                      | 9,595.60         |
|                                                                            | <hr/> 20,445.04  |
| July 1, 1917, balance available                                            | 20,445.04        |

## REID-BEDFORD BEND, LA.

|                                                       |                 |
|-------------------------------------------------------|-----------------|
| Aug. 14, 1916, approved allotment                     | 100,000.00      |
| June 30, 1917, expended during fiscal year            | 26,479.61       |
|                                                       | <hr/> 73,520.39 |
| July 1, 1917, balance unexpended                      | 73,520.39       |
| July 1, 1917, outstanding liabilities                 | \$5,850.31      |
| July 1, 1917, amount covered by uncompleted contracts | 26,000.00       |
|                                                       | <hr/> 31,850.31 |
| July 1, 1917, balance available                       | 41,670.08       |

## RED FORK, ARK.

|                                            |                 |
|--------------------------------------------|-----------------|
| Aug. 14, 1916, approved allotment          | 80,000.00       |
| June 30, 1917, expended during fiscal year | 67,976.93       |
|                                            | <hr/> 12,023.07 |
| July 1, 1917, balance unexpended           | 12,023.07       |
| July 1, 1917, outstanding liabilities      | 12,023.07       |

*Appropriation for claims for damages by collision, river and harbor works, general defense act Sept. 18, 1916.*

|                                                                                           |         |
|-------------------------------------------------------------------------------------------|---------|
| Oct. 19, 1916, allotted for payment of claim of Miller Engineering Co., Little Rock, Ark. | \$47.98 |
| June 30, 1917, expended during fiscal year                                                | 47.98   |

## APPENDIX 4.

## IMPROVING MISSISSIPPI RIVER, FOURTH DISTRICT.

This district extends from Warrenton, Miss.,  $7\frac{1}{2}$  miles below Vicksburg, Miss., to the Head of Passes, about 13 miles from the Gulf of Mexico, a distance of 453 miles by river.

District headquarters, New Orleans, La.

District officer: Maj. W. G. Caples, Corps of Engineers, until November 30, 1916; Maj. Richard C. Moore, Corps of Engineers, until April 29, 1917; Capt.

Beverly C. Dunn, Corps of Engineers, until May 10, 1917; Lieut. Col. George McC. Derby, United States Army, since May 11, 1917.

President of the Mississippi River Commission, Col. C. McD. Townsend, Corps of Engineers.

## WORKS.

## I. Revetments:

- (a) Hard Times Bend.
- (b) Bondurant Chute.
- (c) Kempe Bend.
- (d) Harbors at Natchez, Miss., and Vidalia, La.
- (e) Junction of the Mississippi, Red, and Atchafalaya Rivers.
- (f) Grand Bay.
- (g) Plaquemine, La.
- (h) Harbor at New Orleans, La.
- (i) General repairs and stone.

## II. Levees:

- (a) Lower Tensas levee district.
- (b) Atchafalaya levee district.
- (c) Lafourche levee district.
- (d) Barataria levee district.
- (e) Homochitto levee district.
- (f) Pontchartrain levee district.
- (g) Lake Borgne levee district.

## III. Surveys:

## IV. Plant:

- (a) Revetment plant.
- (b) Levee plant.

## I. REVETMENTS.

(a) *Hard Times Bend.*

*Location.*—Six hundred and thirty-three miles below Cairo, right bank.

*Original condition.*—Caving in this bend has been in progress from an early date. The exact date when caving commenced is not known. The caving continued until, in 1910, it threatened the controlling levee line crossing the foot of Lake St. Joseph. The destruction of this line would necessitate the building of a long and expensive loop levee back of the lake and the abandonment of much valuable land.

*Previous projects.*—None.

*Present project.*—The present project was adopted by the Mississippi River Commission in 1910, and is to protect, with standard revetment of willow mattresses and upper-bank paving, those caving banks where the levee line in Hard Times Bend is most threatened.

*Operations and results prior to the present year.*—Under the existing project a total of 7,689 linear feet of bank has been protected with mattresses 300 feet wide, and the upper bank paved with rock. The amounts spent for original work and for maintenance prior to the beginning of the present year were \$242,116.25 and \$9,818.14, respectively, a total of \$251,934.39. The work has been successful in protecting the levee line in its immediate rear. The project is uncompleted.

*Operations and results during the present year.*—Operations for the year consisted in widening the channel mats placed previous years from 300 to 400 feet between sections 36 and 41, covering a length of 2,580 feet of bank, and requiring 2,400 squares of mattress; placing connecting mats for 200 feet requiring 367 squares, and upper bank pavement for 500 feet requiring 1,008 squares, at upper end of the revetment where scour had developed back of the mats; repairing cave 150 feet long at section 36, requiring 485 squares of mattress and 217 squares of pavement; sinking one connecting piece at lower end of revetment where scour had developed back of the mat, covering 120 feet of bank and requiring 150 squares of mattress; miscellaneous repairs to pavement, 279 squares, and cutting timber 300 feet wide for about 3,000 feet above the revetment to prevent forming obstructions to proposed extension of work upstream.

The mats used were of the framed type and were constructed 20 miles above at Lake Palmyra and towed to Hard Times.

The upper bank was paved with concrete 4 inches thick and rock 10 inches thick. At the ends where scour might undermine the concrete it was reinforced with wire mesh. There were used 325 squares of concrete with wire reinforcement, 670 without, and 509 squares of rock pavement.

Work was commenced November 9, 1916, when a force was sent to Lake Palmyra to build mats, and completed January 19, 1917, when the cutting of the timber above the revetment was finished.

The work was done by hired labor, with Government plant, at a total field cost of \$34,027.22, of which \$12,755.20 was for new work and \$21,272.02 for maintenance.

The cost of the work done, as given above, includes \$568.99 for cutting timber above the present revetment, and should be charged to future work in this bend. The detailed costs are shown in the following tables:

## HARD TIMES BEND (633 R.), FOURTH DISTRICT.

*Mattresses, total area 3,402 squares (channel mats, 84.8 per cent; connecting mats, 15.2 per cent).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$165.15    |             | \$0.049 |
| Timber.....                          | 165,991         | 2,375.33    | 48.792      | .698    |
| Nails, No. 12..... pounds.....       | 1,321           | 30.51       | .388        | .009    |
| Nails, wire..... do.....             | 19,172          | 563.84      | 5.636       | .166    |
| Wire nails..... number.....          | 31,284          | 74.79       | 9.196       | .022    |
| Brush and poles..... cords.....      | 3,545           | 2,928.72    | 1.042       | .861    |
| Miscellaneous expenses.....          |                 | 278.25      |             | .081    |
| Subsistence.....                     |                 | 653.80      |             | .192    |
| Steamboat expenses.....              |                 | 852.60      |             | .251    |
| Motor.....                           |                 | 1,745.22    |             | .513    |
| Supervision.....                     |                 | 327.00      |             | .096    |
| Total field cost.....                |                 | 9,995.21    |             |         |

## BALLASTING AND SINKING.

|                                      |        |           |       |         |
|--------------------------------------|--------|-----------|-------|---------|
| Mobilization and demobilization..... |        | \$321.53  |       | \$0.095 |
| Brush strand..... pounds.....        | 350    | 15.00     | 0.103 | .004    |
| Timber.....                          | 10,405 | 149.83    | 3.058 | .044    |
| Nails, No. 12..... pounds.....       | 1,800  | 67.50     | .529  | .019    |
| Nails, wire..... do.....             | 1,100  | 33.00     | .323  | .009    |
| Steel..... tons.....                 | 3,066  | 6,898.50  | .901  | 2.028   |
| Miscellaneous expenses.....          |        | 340.20    |       | .100    |
| Subsistence.....                     |        | 844.40    |       | .249    |
| Steamboat expenses.....              |        | 777.08    |       | .228    |
| Motor.....                           |        | 1,810.66  |       | .532    |
| Supervision.....                     |        | 226.15    |       | .067    |
| Total field cost.....                |        | 11,483.85 |       |         |

*Grading (1,865 linear feet or 2,040 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$96.63     |             | \$0.047 |
| Timber..... tons.....                | 61.20           | 293.76      | 0.030       | .144    |
| Miscellaneous expenses.....          |                 | 10.87       |             | .005    |
| Subsistence.....                     |                 | 624.00      |             | .305    |
| Steamboat expenses.....              |                 | 527.52      |             | .259    |
| Motor.....                           |                 | 114.96      |             | .057    |
| Supervision.....                     |                 | 1,480.00    |             | .725    |
|                                      |                 | 110.52      |             | .055    |
| Total field cost.....                |                 | 3,258.26    |             |         |

*Paving, rock and concrete (720 linear feet or 1,504 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$446.19    |             | \$0.297 |
| Stone.....tons.....                  | 712             | 1,602.00    | 1.399       | 3.147   |
| Cement.....sacks.....                | 6,616           | 2,679.48    | 6.649       | 2.693   |
| Sand and gravel.....cubic yards..... | 1,129           | 350.22      | 1.135       | .352    |
| Coal.....tons.....                   | 17.45           | 89.32       | .018        | .090    |
| Oil.....                             |                 | 5.95        |             | .006    |
| Miscellaneous expenses.....          |                 | 795.97      |             | .363    |
| Subsistence.....                     |                 | 897.80      |             | .597    |
| Steamboat expenses.....              |                 | 464.46      |             | .309    |
| Labor.....                           |                 | 1,967.70    |             | 1.308   |
| Supervision.....                     |                 | 316.98      |             | .211    |
| Total field cost.....                |                 | 9,616.07    |             |         |

*Summary of costs (3,050 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|--------------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....      | \$6.313          | \$21,479.15 | \$8.560                  | \$12,874.33 | \$34,353.48  | \$11.26                     |
| Office expenses.....       | .436             | 1,483.56    | .591                     | 889.55      | 2,373.11     | .78                         |
| Surveys.....               | .099             | 337.72      | .134                     | 202.49      | 540.21       | .17                         |
| Care of plant.....         | .198             | 673.94      | .259                     | 389.06      | 1,063.00     | .35                         |
| Repair of plant.....       | 1.456            | 4,953.52    | .852                     | 1,282.32    | 6,235.84     | 2.04                        |
| Depreciation of plant..... | .361             | 1,228.61    | .489                     | 736.67      | 1,965.29     | .64                         |
| Total.....                 | 8.863            | 30,156.50   | 10.885                   | 16,374.42   | 46,530.92    | 15.24                       |

<sup>1</sup> Cost per square completed upper bank work.

The field work was in charge of Asst. Engineer E. B. Geddes, assisted by Junior Engineer Geo. C. Schoenberger and Supt. J. R. Allen.

*Condition at end of present year.*—A total of 7,689 linear feet of standard bank revetment of willow mattresses and stone has been placed on the bank in front of a portion of the threatened levee, but a further extension of 3,000 linear feet is necessary to fully accomplish the results for which the work was designed. So far as is known, the work in place is in good condition. The annual survey developed the fact that scour is taking place outside of the present mats.

Total expenditures on existing project were \$250,227.43 for new work, and \$31,187.06 for maintenance, making a total of \$281,414.49. The project has not yet been completed.

*Local cooperation.*—None.

*Proposed operations.*—Three-tenths, approximately, of the project remains uncompleted and consists of revetting unprotected bank. It is proposed to maintain the existing revetment and to extend it upstream as far as funds will permit, estimated at about 3,000 feet.

*Effect of improvement.*—The effect of the improvement has been to correct permanently locate, and deepen the channel, to protect the banks of the river and to preserve the controlling levee line.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |             |
|--------------------------------------------|-------------|
| New work.....                              | \$263,506.8 |
| Maintenance.....                           | 41,770.6    |
| Total expended.....                        | 305,277.4   |
| Total appropriations to June 30, 1917..... | 381,000.0   |

| Fiscal year ending June 30. | 1913       | 1914         | 1915       | 1916        | 1917        |
|-----------------------------|------------|--------------|------------|-------------|-------------|
| ended for new work.....     |            | \$140,609.13 | \$9,691.59 | \$90,012.77 | \$21,390.58 |
| ended for maintenance.....  | \$149.83   |              | 507.76     | 6,903.10    | 31,952.51   |
| Total expended.....         | 149.83     | 140,609.13   | 10,199.35  | 96,915.87   | 53,343.09   |
| ropriated or allotted.....  | 140,000.00 | 10,000.00    | 126,000.00 | 100,000.00  |             |

ly 1, 1916, balance unexpended..... \$29,065.61  
 amount allotted from river and harbor act approved July 27, 1916... 100,000.00  
 129,065.61

ne 30, 1917, amount expended during fiscal year, exclusive of re-  
 cepts from sales:  
 For new work..... \$21,390.58  
 For maintenance..... 31,952.51  
 53,343.09

ly 1, 1917, balance unexpended..... 75,722.52  
 ly 1, 1917, outstanding liabilities..... 4,992.72  
 ly 1, 1917, amount covered by uncompleted contracts... 39,890.03  
 44,882.75

ily 1, 1917, balance available..... 30,839.77  
 balance available for fiscal year ending June 30, 1918..... 30,839.77

#### Abstract of appropriations.

| Act of Congress.                    | Allotted.     | Amount.    |
|-------------------------------------|---------------|------------|
| ne 25, 1910 (river and harbor)..... | July 6, 1910  | \$5,000.00 |
| r. 4, 1913 (river and harbor).....  | Apr. 30, 1913 | 140,000.00 |
| t. 2, 1914 (river and harbor).....  | Oct. 20, 1914 | 10,000.00  |
| r. 4, 1915 (river and harbor).....  | Apr. 26, 1915 | 126,000.00 |
| y 27, 1916 (river and harbor).....  | Aug. 14, 1916 | 100,000.00 |
| Total.....                          |               | 381,000.00 |

Original allotment, \$168,000; \$42,000 transferred to harbors at Natchez and Vidalia, Miss and La.

*Contracts in force.*—None.

#### (b) Bondurant Chute.

*Location.*—Six hundred and forty-three miles below Cairo, right bank.

*Original condition.*—Caving in this bend commenced in 1880 and continued until 1889, when it threatened the last practicable line of levee between the river and Lake Bruen. The abandonment of the existing levee would have necessitated the construction of a long line of new levee behind Lake Bruen and the exposure to overflow of a large area of cultivated land.

*Previous projects.*—None.

*Present project.*—The present project was adopted by the Mississippi River Commission in 1899 and provided for revetting the caving bank with board mattresses 100 feet wide, grading the upper bank, and paving it with concrete-in-situ. The project was modified in 1900 to provide for the use of standard mattresses of willow brush. A further modification in 1903 provided for the use of rock for upper-bank paving.

*Operations and results prior to present year.*—Under the project and modifications work was commenced in 1899 and a total of 4,150 linear feet of bank were protected with mattresses from 100 to 200 feet wide and the upper bank was paved. The original board mattresses were reinforced with mattresses of willow brush and most of the concrete-in-situ upper-bank paving was replaced with rock. The work has been successful in maintaining the levee in front of Lake Bruen. The amount spent for original work was \$62,282 and for maintenance was \$16,047.18, a total of \$78,500.

*Operations and results during the present year.*—Operations during the year consisted in repairing cave between sections 6 and 9, and storing rock on the bank for future use. The bank in the cave was matted 150 feet wide for 740 linear feet, requiring 1,170 squares, and the upper bank was graded and paved with rock for 820 feet, requiring 225 squares of pavement. In addition to 886 tons already on hand, there were unloaded on the bank in the chute 1,444 tons of rock to be used next season for extending the work downstream.

The channel mats, amounting to 1,050 squares, were constructed at Lake Palmyra and towed into the chute when the river had reached a suitable stage to permit boats to operate in the channel of the chute.

The connecting mats, amounting to 120 squares, were constructed in the chute from willows on Bondurant Island.

Work was commenced January 4, 1917, and completed February 18, 1917.

The work was done by hired labor with Government plant, at a total field cost of \$13,001.63 for maintenance.

The detailed costs are shown in the following tables:

BONDURANT CHUTE (643 R.), FOURTH DISTRICT.

*Mattresses, total area 1,170 squares (channel mats, 89.7 per cent; connecting mats, 10.3 per cent).*

BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$48.35     |             | \$0.04 |
| Lumber..... foot.....                | 72,136          | 1,041.27    | 61,655      | .89    |
| Wire, No. 12..... pounds.....        | 515             | 14.12       | .440        | .01    |
| Nails, wire.....                     | 6,414           | 193.72      | 5.481       | .16    |
| Treenails..... No.....               | 9,692           | 23.25       | 8.283       | .02    |
| Brush and poles..... cord.....       | 1,219           | 807.23      | 1.042       | .67    |
| Subsistence.....                     |                 | 142.53      |             | .12    |
| Steamboat expenses.....              |                 | 843.54      |             | .72    |
| Labor.....                           |                 | 1,022.85    |             | .87    |
| Supervision.....                     |                 | 150.73      |             | .12    |
| Total field cost.....                |                 | 4,287.59    |             |        |

BALLASTING AND SINKING.

| Items.                                      | Quantity used.  |             | Per square. |        |
|---------------------------------------------|-----------------|-------------|-------------|--------|
|                                             | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization.....        |                 | \$150.40    |             | \$0.12 |
| $\frac{3}{8}$ -inch strand..... pounds..... | 280             | 12.00       | \$0.239     | .01    |
| Lumber..... foot.....                       | 500             | 7.20        | .427        | .00    |
| Wire, No. 12..... pounds.....               | 500             | 20.00       | .427        | .01    |
| Nails, wire.....                            | 672             | 20.46       | .574        | .01    |
| Stone..... tons.....                        | 898             | 2,215.70    | .767        | 1.88   |
| Miscellaneous expenses.....                 |                 | 32.17       |             | .00    |
| Subsistence.....                            |                 | 330.71      |             | .28    |
| Steamboat expenses.....                     |                 | 845.84      |             | .72    |
| Labor.....                                  |                 | 724.03      |             | .61    |
| Supervision.....                            |                 | 240.47      |             | .20    |
| Total field cost.....                       |                 | 4,598.98    |             |        |

*Grading (820 linear feet, or 250 squares).*

| Items.                              | Quantity used.  |             | Per square. |         |
|-------------------------------------|-----------------|-------------|-------------|---------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization..... |                 | \$59.00     |             | \$0.235 |
| bsistence.....                      |                 | 158.70      |             | .635    |
| eamboat expenses.....               |                 | 30.20       |             | .121    |
| bor.....                            |                 | 512.16      |             | 2.049   |
| persvision.....                     |                 | 95.00       |             | .380    |
| Total field cost.....               |                 | 855.06      |             |         |

*Paving, rock and concrete (820 linear feet, or 225 squares).*

| Items.                              | Quantity used.  |             | Per square. |         |
|-------------------------------------|-----------------|-------------|-------------|---------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization..... |                 | \$100.00    |             | \$0.444 |
| one..... tons.....                  | 845             | 2,138.80    | 3.755       | 9.506   |
| iscellaneous expenses.....          |                 | 30.95       |             | .138    |
| bsistence.....                      |                 | 186.12      |             | .827    |
| eamboat expenses.....               |                 | 339.76      |             | 1.510   |
| bor.....                            |                 | 403.90      |             | 1.795   |
| persvision.....                     |                 | 60.47       |             | .269    |
| Total field cost.....               |                 | 3,260.00    |             |         |

*Summary of costs (820 linear feet revetted).*

|                           | Subaqueous work. |            | Upper bank work.         |            | Grand total. | Total cost per linear foot. |
|---------------------------|------------------|------------|--------------------------|------------|--------------|-----------------------------|
|                           | Per square.      | Total.     | Per square. <sup>1</sup> | Total.     |              |                             |
| total field cost.....     | \$7.595          | \$8,886.57 | \$17.909                 | \$4,115.06 | \$13,001.63  | \$15.855                    |
| ffice expenses.....       | .381             | 445.33     | .961                     | 216.15     | 664.88       | .81                         |
| are of plant.....         | .132             | 154.58     | .317                     | 71.42      | 226.00       | .27                         |
| epair of plant.....       | .872             | 1,019.73   | 2.094                    | 471.11     | 1,490.84     | 1.82                        |
| epreciation of plant..... | .446             | 522.09     | 1.075                    | 241.91     | 764.00       | .93                         |
| Total.....                | 9.426            | 11,028.30  | 22.356                   | 5,115.65   | 16,147.35    | 19.68                       |

<sup>1</sup> Cost per square completed upper bank work.

*Condition at end of present year.*—A total of 4,150 linear feet of bank protection has been placed, covering that portion of the bank where the levee was threatened. Changes in the channel at the head of the chute has caused filling along the upper revetment, but has increased the strain against the lower part and caused active caving below the revetment. Total expenditures on existing project were \$62,452.82 for new work, and \$27,978.12 for maintenance, making a total of \$90,430.94. The project appears to be completed, but further extension downstream will probably be necessary.

*Local cooperation.*—None.

*Proposed operations.*—Maintenance of the existing revetment

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river and preserve the controlling levee line.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                                   |                  |
|---------------------------------------------------|------------------|
| New work.....                                     | \$62,452.8       |
| Maintenance.....                                  | 27,907.0         |
| <b>Total expended.....</b>                        | <b>90,359.8</b>  |
| <b>Total appropriations to June 30, 1917.....</b> | <b>113,500.0</b> |

| Fiscal year ending June 30.   | 1913        | 1914            | 1915            | 1916            | 1917            |
|-------------------------------|-------------|-----------------|-----------------|-----------------|-----------------|
| Expended for new work.....    |             | \$7,661.82      | \$957.45        |                 |                 |
| Expended for maintenance..... |             | 992.39          | 440.02          | \$1,210.71      | \$11,859.8      |
| <b>Total expended.....</b>    |             | <b>8,654.21</b> | <b>1,397.47</b> | <b>1,210.71</b> | <b>11,859.8</b> |
| Appropriated or allotted..... | \$10,500.00 |                 |                 | 35,000.00       |                 |

Amount allotted from river and harbor act approved July 27, 1916... \$35,000.0  
 June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... 11,859.8

July 1, 1917, balance unexpended..... 23,140.1  
 July 1, 1917, outstanding liabilities..... 3,650.5

July 1, 1917, balance available for fiscal year ending June 30, 1918... 19,489.6

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.        | Amount.           |
|---------------------------------------|------------------|-------------------|
| Mar. 3, 1899 (sundry civil).....      | July 5, 1899     | \$10,000.00       |
| Do.....                               | Mar. 26, 1900    | 10,000.00         |
| June 13, 1902 (river and harbor)..... | July 12, 1902    | 10,000.00         |
| Mar. 3, 1903 (sundry civil).....      | July 21, 1903    | 5,000.00          |
| Apr. 28, 1904 (sundry civil).....     | Apr. 1, 1904     | 3,000.00          |
| Mar. 3, 1905 (sundry civil).....      | Apr. 26, 1905    | 2,000.00          |
| June 30, 1906 (sundry civil).....     | June 28, 1906    | 3,000.00          |
| Do.....                               | Sept. 10, 1906   | 15,000.00         |
| Mar. 2, 1907 (river and harbor).....  | Mar. 27, 1907    | 3,000.00          |
| May 27, 1908 (sundry civil).....      | May 4, 1908      | 2,000.00          |
| Mar. 4, 1909 (sundry civil).....      | Apr. 28, 1909    | 5,000.00          |
| Mar. 4, 1913 (river and harbor).....  | ( <sup>1</sup> ) | 10,500.00         |
| July 27, 1916 (river and harbor)..... | Aug. 14, 1916    | 35,000.00         |
| <b>Total.....</b>                     |                  | <b>113,500.00</b> |

<sup>1</sup> By transfer.

*Contracts in force.*—None.

(c) *Kempe Bend.*

*Location.*—Six hundred and fifty-eight miles below Cairo, right bank.

*Original condition.*—Caving in this bend commenced about 1865 and continued with unusual rapidity, destroying one levee after another until 1899, when it had nearly reached a final line of levee, the destruction of which would have necessitated a new levee of extremely difficult and costly construction. The construction of a new line would have required a long period of time, and a break in the front line in the meantime would have been disastrous to a large section of country.

*Previous projects.*—None.

*Present project.*—The present project was adopted by the Mississippi River Commission in 1899, and provided for revetting the caving bend with standard revetment of willow mattresses and upper-bank paving of rock.

*Operations and results prior to the present year.*—The work was commenced in 1899, and a total of 28,616 linear feet of bank was protected with mattress

00 feet wide, and the upper bank was paved with rock. Numerous failures of the revetment occurred, permitting the upper bank to recede in places, but not seriously jeopardizing the levee line which it was designed to protect. All breaks in the revetment were repaired. The effect of the work was to preserve the levee line. The amount spent for original work was \$1,104,977.70 and for maintenance was \$250,578.75, a total of \$1,355,556.45.

*Operations and results during the present year.*—Operations during the year at Kempe Bend were confined to making needed repairs to existing work as follows: The cave between sections 27 and 33 was matted with 300 feet wide for 986 linear feet, requiring 5,218 squares, leaving a gap of 300 feet unprotected where on account of the high stage of the river and swift current it was impracticable to sink mats.

The upper bank along this stretch was graded for 2,080 linear feet and paved with rock and concrete to about a 30-foot stage for 1,100 feet, requiring 640 squares of rock and 467 squares of concrete pavement. The cave at section 41 was matted with mats 200 feet wide for 450 feet, requiring 788 squares. The timber along the caves lower down in the bend was felled 200 feet wide or a length of 2,500 linear feet.

The mats for this work were constructed at Lake Palmyra and towed to Kempe Bend, a distance of about 55 miles.

Work was commenced November 24, 1916, and continued when river conditions permitted until February 25, 1917, when all work was suspended on account of high water.

The work was done by hired labor with Government plant, at a total field cost of \$48,158.94 for maintenance.

The above cost includes \$486.77 expended in cutting timber where future work is contemplated.

The detailed costs of the revetment are shown in the following tables:

#### KEMPE BEND (658 R.), FOURTH DISTRICT.

*Mattresses, total area 6,006 squares (channel mats, 100 per cent).*

#### BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$197.40    |             | \$0.033 |
| Lumber.....                          | 295,594         | 4,257.51    | 49.216      | .709    |
| Wire, No. 12..... pounds.....        | 2,322           | 63.73       | .387        | .011    |
| Nails, wire.....                     | 34,141          | 1,032.37    | 5.684       | .172    |
| Greenails..... number.....           | 55,134          | 131.83      | 9.179       | .022    |
| Brush and poles..... cords.....      | 6,252           | 5,276.13    | 1.041       | .878    |
| Rope, manila..... pounds.....        |                 | 292.86      |             | .049    |
| Miscellaneous expenses.....          |                 | 138.68      |             | .023    |
| Subsistence.....                     |                 | 1,633.83    |             | .272    |
| Steamboat expenses.....              |                 | 1,732.70    |             | .288    |
| Labor.....                           |                 | 2,530.87    |             | .422    |
| Supervision.....                     |                 | 718.60      |             | .119    |
| Total field cost.....                |                 | 18,006.51   |             |         |

#### BALLASTING AND SINKING.

|                                      |        |           |       |         |
|--------------------------------------|--------|-----------|-------|---------|
| Mobilization and demobilization..... |        | \$573.53  |       | \$0.095 |
| 1/4-inch strand..... pounds.....     | 700    | 30.00     | 0.116 | .005    |
| Lumber.....                          | 10,000 | 144.00    | 1.664 | .024    |
| Wire, No. 12..... pounds.....        | 2,500  | 100.00    | .416  | .017    |
| Nails, wire.....                     | 4,000  | 120.00    | .666  | .019    |
| Stone..... tons.....                 | 4,696  | 11,035.60 | .782  | 1.837   |
| Rope, manila..... pounds.....        |        | 439.29    |       | .075    |
| Miscellaneous expenses.....          |        | 145.20    |       | .024    |
| Subsistence.....                     |        | 780.00    |       | .129    |
| Steamboat expenses.....              |        | 855.70    |       | .142    |
| Labor.....                           |        | 2,384.92  |       | .398    |
| Supervision.....                     |        | 621.34    |       | .103    |
| Total field cost.....                |        | 17,229.58 |       |         |

*Grading (2,080 linear feet or 2,088 squares).*

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$64.40     |             | \$0.03 |
| Rope, manila..... pounds.....        |                 | 292.86      |             | .14    |
| Coal..... tons.....                  | 125             | 675.00      | 0.059       | .32    |
| Oil.....                             |                 | 37.94       |             | .01    |
| Miscellaneous expenses.....          |                 | 46.20       |             | .02    |
| Subsistence.....                     |                 | 813.07      |             | .38    |
| Steamboat expenses.....              |                 | 90.60       |             | .04    |
| Labor.....                           |                 | 2,084.89    |             | 1.00   |
| Supervision.....                     |                 | 308.60      |             | .14    |
| Total field cost.....                |                 | 4,413.56    |             |        |

*Paving, rock and concrete (1,100 linear feet or 1,107 squares).*

| Items.                                | Quantity used.  |             | Per square. |        |
|---------------------------------------|-----------------|-------------|-------------|--------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization.....  |                 | \$284.44    |             | \$0.25 |
| Stone..... tons.....                  | 1,630           | 3,830.50    | 2.547       | 5.98   |
| Rope, manila..... pounds.....         |                 | 292.86      |             | .28    |
| Cement..... sacks.....                | 3,368           | 1,364.04    | 7.212       | 2.92   |
| Sand and gravel..... cubic yards..... | 575             | 178.37      | 1.231       | .38    |
| Coal..... tons.....                   | 5.82            | 29.80       | .013        | .06    |
| Oil.....                              |                 | 2.00        |             | .00    |
| Miscellaneous expenses.....           |                 | 26.99       |             | .02    |
| Subsistence.....                      |                 | 341.59      |             | .30    |
| Steamboat expenses.....               |                 | 435.12      |             | .38    |
| Labor.....                            |                 | 1,044.03    |             | .94    |
| Supervision.....                      |                 | 192.78      |             | .17    |
| Total field cost.....                 |                 | 8,022.52    |             |        |

*Summary of costs (2,436 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|--------------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....      | \$5.867          | \$35,236.09 | \$9.365                  | \$12,436.08 | \$47,672.17  | \$19.                       |
| Office expenses.....       | .308             | 1,847.00    | .589                     | 651.87      | 2,642.02     | 1.                          |
| Surveys.....               | .122             | 730.70      | .233                     | 257.88      | 988.58       | .                           |
| Care of plant.....         | .136             | 819.67      | .322                     | 356.33      | 1,176.00     | .                           |
| Repair of plant.....       | .720             | 4,326.41    | .169                     | 1,866.43    | 6,192.84     | 2.                          |
| Depreciation of plant..... | .345             | 2,070.70    | .660                     | 730.83      | 2,801.53     | 1.                          |
| Total.....                 | 7.498            | 45,030.57   | 11.338                   | 16,299.42   | 61,473.14    | 25.                         |

<sup>1</sup> Cost per square completed upper bank work.

*Condition at end of present year.*—A total of 28,616 linear feet of bank has been protected with a standard revetment of willow mattresses and stone, and the controlling levee line has been preserved. In past years numerous failures of the revetment have occurred and have been repaired. A recent failure of a length of about 2,500 feet has not so far been repaired because of extreme high water. None of the failures have seriously jeopardized the levee line. The project is considered completed, but annual maintenance will be required.

Total expenditures on existing project were \$1,104,977.70 for new work and \$298,472.93 for maintenance, making a total of \$1,403,450.63. The project has been completed, but annual maintenance will be necessary.

*Local cooperation.*—None.

*Proposed operations.*—Maintenance of existing revetment.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate and deepen the channel, to protect the banks of the river, and to preserve the controlling levee line.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |                   |
|--------------------------------------------|-------------------|
| New work.....                              | \$1, 104, 977. 70 |
| Maintenance.....                           | 305, 181. 15      |
| Total expended.....                        | 1, 410, 158. 85   |
| Total appropriations to June 30, 1917..... | 1, 440, 000. 00   |

| Fiscal year ending June 30.   | 1913           | 1914          | 1915          | 1916         | 1917        |
|-------------------------------|----------------|---------------|---------------|--------------|-------------|
| Expended for new work.....    | \$113, 114. 68 |               |               |              |             |
| Expended for maintenance..... | 11, 371. 34    | \$24, 782. 12 | \$52, 142. 03 | \$9, 009. 65 | 54, 602. 40 |
| Total expended.....           | 124, 486. 02   | 24, 782. 12   | 52, 142. 03   | 9, 009. 65   | 54, 602. 40 |
| Appropriated or allotted..... | 19, 000. 00    | 60, 000. 00   | 20, 000. 00   | 65, 000. 00  |             |

July 1, 1916, balance unexpended..... \$19, 443. 55  
Amount allotted from river and harbor act approved July 27, 1916... 65, 000. 00

84, 443. 55

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... 54, 602. 40

July 1, 1917, balance unexpended..... 29, 841. 15

July 1, 1917, outstanding liabilities..... \$3, 677. 97

July 1, 1917, amount covered by uncompleted contracts... 1, 601. 42

5, 279. 39

July 1, 1917, balance available for fiscal year ending June 30, 1918... 24, 561. 76

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.     | Amount.         |
|---------------------------------------|---------------|-----------------|
| Mar. 3, 1899 (sundry civil).....      | Mar. 13, 1900 | \$180, 000. 00  |
| June 6, 1900 (sundry civil).....      | July 14, 1900 | 150, 000. 00    |
| June 13, 1902 (river and harbor)..... | July 12, 1902 | 60, 000. 00     |
| Mar. 3, 1903 (sundry civil).....      | July 21, 1903 | 64, 000. 00     |
| Do.....                               | (1)           | 30, 000. 00     |
| Mar. 28, 1904 (sundry civil).....     | Apr. 1, 1904  | 80, 000. 00     |
| Mar. 3, 1905 (river and harbor).....  | Apr. 26, 1905 | 90, 000. 00     |
| June 30, 1906 (sundry civil).....     | June 28, 1906 | 50, 000. 00     |
| Mar. 2, 1907 (river and harbor).....  | Mar. 27, 1907 | 12, 000. 00     |
| May 27, 1908 (sundry civil).....      | (1)           | 25, 000. 00     |
| Mar. 4, 1909 (sundry civil).....      | Apr. 28, 1909 | 65, 000. 00     |
| June 25, 1910 (sundry civil).....     | Apr. 30, 1910 | 90, 000. 00     |
| Do.....                               | (1)           | 10, 000. 00     |
| Feb. 27, 1911 (river and harbor)..... | May 3, 1911   | 275, 000. 00    |
| Do.....                               | (1)           | 5, 000. 00      |
| July 25, 1912 (river and harbor)..... | Aug. 3, 1912  | 90, 000. 00     |
| Mar. 4, 1913 (river and harbor).....  | Apr. 30, 1913 | 19, 000. 00     |
| Oct. 2, 1914 (river and harbor).....  | Oct. 15, 1914 | 60, 000. 00     |
| Mar. 4, 1915 (river and harbor).....  | Apr. 18, 1915 | 20, 000. 00     |
| July 27, 1916 (river and harbor)..... | Aug. 14, 1916 | 65, 000. 00     |
| Total.....                            |               | 1, 440, 000. 00 |

<sup>1</sup> By transfer.

<sup>2</sup> Original allotment, \$50,000; \$30,000 transferred to harbors at Natchez and Vidalia, Miss. and La.

*Contracts in force.*—None.

*(d) Harbors at Natchez, Miss., and Vidalia, La.*

*Location.*—From 687 to 700 miles below Cairo, left and right banks.

*Original condition.*—Caving of the river banks in Giles and Marengo Bends and in front of the city of Natchez, was in existence as far back as any authentic record exists. In Giles Bend the caving had progressed to such an extent that a cut-off was threatened through the neck of land between Giles and Cowpen Bends, which cut-off would have destroyed the harbors of Natchez and Vidalia, as well as causing a serious disturbance of the general regime of the river for many miles above and below. In Marengo Bend the caving had destroyed the last practicable line of levee between Lake Concordia and the river and caused the construction of a new line behind the lake in 1881. Many thousand acres of valuable farming lands had been destroyed. The caving continued and in 1912 threatened the destruction of the new line behind the lake, as well as an important railroad line. In front of the city of Natchez continued caving had destroyed nearly all of the historic "Natchez under-the-Hill," and was threatening the site of the waterworks supplying the city of Natchez.

*Previous projects.*—The work originated in a joint congressional resolution passed June 28, 1879. The project provided for protecting the caving bank in Giles and Marengo Bends with brush and stone. Work was carried on under this project during 1881 and 1882. Amount expended, \$82,470.91. No trace of this work remains.

*Present project.*—Under act of August 2, 1882, the work was placed under the direction of the Mississippi River Commission, but remained dormant except for frequent surveys and examinations, until 1892. On November 2, 1892, the commission adopted a project calling for the construction of a levee along the axis of Cowpen Neck to prevent the flow of water during high stage of the river across the neck and consequent danger of a cut-off. On March 30, 1897, a project was adopted for the protection of the bank in Giles Bend by means of submerged sloping spur dikes placed at intervals of about 450 feet. In 1899 the project was modified to provide for continuous revetment of the standard type, with mattresses 300 feet wide, together with upper-bank pavement, the latter to be placed only after the action of the river had graded the upper bank to a sufficiently flat slope. This restriction, so far as it related to work subsequent to 1899, was removed in June, 1900. In 1907 the project was modified to include the revetment of the Natchez front with standard revetment, and in 1912 to include the revetment of Marengo Bend.

*Operations and results prior to the present year.*—In Giles Bend the spur levee was completed in 1895 and was raised and enlarged in 1898. The levee had a length of 19,500 feet. Work on the revetment was begun in 1897 and continued from year to year until in 1911 it had a total length of 23,454 feet. Since 1911 about 3,989 feet of the revetment has been destroyed by caving together with about the same length of levee. The effective length of revetment was reduced to 19,464 feet, and of the levee to 15,511 feet. The effect of the work had been to prevent the threatened cut-off between Giles and Cowpen Bends. Amounts spent for original work and for maintenance were \$1,296,587.54 and \$324,897.82, respectively, a total of \$1,621,485.36.

In Marengo Bend a total of 12,844 linear feet of standard revetment was placed. The effect of the work was to preserve the controlling levee. Amounts spent for original work and for maintenance were \$381,857 and \$21,319.80, respectively, a total of \$403,176.86.

On the Natchez front the bank was revetted with standard revetment for 3,546 linear feet in two detached pieces; upper, 2,136 feet long, and the lower, 1,400 feet long, separated by an unprotected gap of about 1,600 feet. The effect of the work was to prevent further recession of the bank where protected and to preserve the site of the waterworks. Amounts spent for original work and for maintenance were \$120,730.26 and \$5,064.58, respectively, a total of \$125,794.84.

The total amounts spent on harbors of Natchez and Vidalia for original work and for maintenance were \$1,799,174.80 and \$351,282.26, respectively, a total of \$2,150,457.06.

*Operations and results during the present year.*—The harbors of Natchez and Vidalia include improvement works in Giles Bend, Marengo Bend, and along the Natchez front.

*Giles Bend.*—Operations for the year consisted in extending the revetment at the lower end; widening the mats between sections 48 and 50, and making

extensive repairs to the lower part of the revetment where caving had occurred, and completing the extension and repairs on Cowpen Point Levee, as follows: The cave between sections 32 and 36 was matted for 1,445 linear feet, requiring 4,796 squares; cave at section 37 matted for 640 linear feet, requiring 1,999 squares; one sinking placed on salient at section 36, requiring 406 squares; two connecting mats placed between sections 48 and 49 covering 300 linear feet of bank, and requiring 365 squares; repairs were made at lower end of revetment and extension covering 300 linear feet, requiring 1,027 squares; widening mats at lower end for 300 linear feet, requiring 450 squares. The upper bank was graded for 3,955 linear feet on the above and paved with concrete and rock for a length of 4,020 linear feet, requiring 3,217 squares of concrete and 243 squares of rock pavement. Of the concrete pavement 537 squares were reinforced with wire mesh.

Work on lot 3 Cowpen Point Levee was completed, and wave wash restored along 6,350 linear feet and the levee resodded; a spur to divert the current from the slope of the levee was constructed 100 feet long containing 1,500 cubic yards of earth, and paved with rock; one piece of mattress constructed and sunk in hole scoured at end of levee, and concrete pavement destroyed, replaced with 444 squares of rock pavement.

During the high water in April some work was found necessary to protect the slope on lot 3 from the current and wave wash, and some additional paving had to be done on the spur.

Work in this bend was commenced on August 15, 1916, and continued with several interruptions until February 5, 1917.

The mats used in Giles were constructed at Kempe Island, about 20 miles above the work.

The work was done by hired labor with Government plant, at a total field cost of \$113,170.37 for maintenance.

The cost as given above includes \$19,571.62 for construction and \$12,151.16 for maintenance at Cowpen Point Levee.

The detailed costs of the revetment are shown in the following tables:

#### GILES BEND (687 L.), FOURTH DISTRICT.

*Mattresses, total area 9,043 squares (channel mats, 95.9 per cent; connecting mats, 4.1 per cent).*

#### BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$296.10    |             | \$0.032 |
| Lumber..... b. m.                    | 446,646         | 5,851.03    | 49,391      | .647    |
| Wire, No. 12..... pounds.            | 3,492           | 70.60       | 386         | .008    |
| Nails, wire.....                     | 50,954          | 920.67      | 5,634       | .102    |
| Treenails..... number                | 83,040          | 298.49      | 9,182       | .033    |
| Brush and poles..... cords.          | 9,422           | 11,029.73   | 1,042       | 1.219   |
| Miscellaneous expenses.....          |                 | 516.12      |             | .057    |
| Subsistence.....                     |                 | 1,788.84    |             | .197    |
| Steamboat expenses.....              |                 | 1,976.72    |             | .219    |
| Labor.....                           |                 | 4,677.52    |             | .518    |
| Supervision.....                     |                 | 979.53      |             | .108    |
| Total field cost.....                |                 | 28,405.35   |             |         |

#### BALLASTING AND SINKING.

|                                      |        |           |       |         |
|--------------------------------------|--------|-----------|-------|---------|
| Mobilization and demobilization..... |        | \$560.25  |       | \$0.061 |
| 1-inch strand..... pounds.           | 1,440  | 60.00     | 0.159 | .007    |
| Lumber..... b. m.                    | 23,140 | 333.22    | 2.558 | .037    |
| Wire, No. 12..... pounds.            | 3,500  | 131.25    | .387  | .014    |
| Nails, wire.....                     | 3,200  | 96.00     | .354  | .011    |
| Stone..... tons.                     | 6,793  | 14,417.30 | .751  | 1.594   |
| Miscellaneous expenses.....          |        | 480.21    |       | .053    |
| Subsistence.....                     |        | 1,995.70  |       | .222    |
| Steamboat expenses.....              |        | 2,487.84  |       | .275    |
| Labor.....                           |        | 3,403.53  |       | .377    |
| Supervision.....                     |        | 837.14    |       | .092    |
| Total field cost.....                |        | 24,802.44 |       |         |

*Grading (3,955 linear feet or 5,219 squares).*

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$247.37    |             | \$0.04 |
| Coal..... tons.....                  | 269.20          | 1,292.16    | 0.051       | .24    |
| Oil.....                             |                 | 91.97       |             | .01    |
| Miscellaneous expenses.....          |                 | 152.00      |             | .02    |
| Subsistence.....                     |                 | 1,841.96    |             | .35    |
| Steamboat expenses.....              |                 | 374.36      |             | .07    |
| Labor.....                           |                 | 3,587.67    |             | .68    |
| Supervision.....                     |                 | 596.15      |             | .11    |
| Total field cost.....                |                 | 8,183.64    |             |        |

*Paving, rock and concrete (4,020 linear feet or 3,460 squares).*

| Items.                                | Quantity used.  |             | Per square. |        |
|---------------------------------------|-----------------|-------------|-------------|--------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization.....  |                 | \$339.70    |             | \$0.09 |
| Stone..... tons.....                  | 362             | 634.13      | 1,489       | 2.60   |
| Cement..... sacks.....                | 22,596          | 9,151.38    | 7,024       | 2.84   |
| Sand and gravel..... cubic yards..... | 4,292           | 1,331.38    | 1,334       | .41    |
| Coal..... tons.....                   | 55.10           | 282.11      | .017        | .08    |
| Oil.....                              |                 | 19.00       |             | .00    |
| Miscellaneous expenses.....           |                 | 1,032.65    |             | .26    |
| Subsistence.....                      |                 | 1,783.76    |             | .55    |
| Steamboat expenses.....               |                 | 1,329.40    |             | .38    |
| Labor.....                            |                 | 4,265.32    |             | 1.23   |
| Supervision.....                      |                 | 571.33      |             | .16    |
| Total field cost.....                 |                 | 20,740.16   |             |        |

*Summary of costs (4,020 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|--------------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....      | \$5.884          | \$53,207.79 | \$8.360                  | \$28,923.80 | \$82,131.59  | \$20.43                     |
| Office expenses.....       | .313             | 2,828.94    | .424                     | 1,467.28    | 4,366.22     | 1.09                        |
| Surveys.....               | .056             | 507.99      | .084                     | 291.52      | 799.51       | .20                         |
| Care of plant.....         | .162             | 1,462.41    | .227                     | 783.84      | 2,246.25     | .56                         |
| Repairs of plant.....      | .872             | 7,888.71    | 1.222                    | 4,229.13    | 12,117.84    | 3.01                        |
| Depreciation of plant..... | .342             | 3,093.49    | .490                     | 1,695.80    | 4,789.29     | 1.19                        |
| Total.....                 | 7.629            | 68,989.33   | 10.807                   | 37,391.37   | 106,450.70   | 26.48                       |

<sup>1</sup> Cost per square complete upper bank work.

*Marengo Bend.*—Operations during the year were confined to making repairs to existing work, as follows:

One connecting mat placed at upper end of revetment where scour had occurred back of the channel mats, containing 150 squares, and the upper bank graded and paved with concrete for 310 linear feet, requiring 860 squares; cave between sections 3 and 4 matted for 425 linear feet, requiring 1,537 squares, and the upper bank paved with rock and concrete for 510 linear feet, requiring 360 squares; connecting mats placed at sections 8 and 12, requiring 150 squares; cave at sections 17 and 19 matted for 817 linear feet, requiring 1,913 squares, and the upper bank graded and paved for 1,050 linear feet, requiring 813 squares; cave between sections 20 and 21 matted for 655 linear

feet, requiring 2,481 squares, and upper bank graded and paved for 880 linear feet, requiring 673 squares; cave at section 22 matted for 175 linear feet, requiring 548 squares, and the upper bank graded and paved for 290 linear feet, requiring 203 squares.

Of the 2,909 squares of pavement placed 871 squares were rock and 2,038 squares concrete. Of the concrete pavement 993 squares were reinforced with wire mesh.

The mats used on this work were constructed on Big Black Island principally, about 70 miles above Giles Bend.

Work was commenced October 3, 1916, and completed March 8, 1917.

The work was done by hired labor with Government plant at a total field cost of \$62,722.16 for maintenance.

The detailed costs are shown in the following tables:

## MARENGO BEND (692 R.), FOURTH DISTRICT.

*Mattresses, total area 6,779 squares (channel mats, 95.6 per cent; connecting mats, 4.4 per cent).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$230.30    |             | \$0.034 |
| Lumber.....                          | 349,623         | 4,825.73    | 51.575      | .712    |
| Wire, No. 12..... pounds             | 2,650           | 51.20       | .391        | .008    |
| Nails, wire..... do                  | 38,623          | 917.31      | 5.697       | .135    |
| Treenails..... do                    | 62,941          | 150.61      | 9.285       | .022    |
| Brush and poles..... cords           | 7,142           | 6,937.47    | 1.054       | 1.024   |
| Miscellaneous expenses.....          |                 | 51.07       |             | .008    |
| Subsistence.....                     |                 | 1,544.48    |             | .228    |
| Steamboat expenses.....              |                 | 1,320.58    |             | .174    |
| Labor.....                           |                 | 4,011.48    |             | .591    |
| Supervision.....                     |                 | 429.97      |             | .063    |
| Total field cost.....                |                 | 20,470.20   |             |         |

## BALLASTING AND SINKING.

|                                      |        |           |       |         |
|--------------------------------------|--------|-----------|-------|---------|
| Mobilization and demobilization..... |        | \$467.45  |       | \$0.069 |
| 1/4-inch strand..... pounds          | 720    | 30.00     | 0.106 | .004    |
| Lumber.....                          | 13,360 | 181.38    | 1.973 | .027    |
| Wire, No. 12..... pounds             | 2,800  | 105.00    | .413  | .015    |
| Nails, wire..... do                  | 3,200  | 96.00     | .472  | .014    |
| Stone..... tons                      | 5,434  | 13,561.20 | .802  | 2.001   |
| Miscellaneous expenses.....          |        | 118.80    |       | .017    |
| Subsistence.....                     |        | 1,078.40  |       | .159    |
| Steamboat expenses.....              |        | 1,066.40  |       | .157    |
| Labor.....                           |        | 2,232.92  |       | .329    |
| Supervision.....                     |        | 577.60    |       | .086    |
| Total field cost.....                |        | 19,515.15 |       |         |

*Grading (3,040 linear feet or 3,045 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$96.80     |             | \$0.032 |
| Coal..... tons                       | 146             | 700.80      | 0.048       | .229    |
| Oil.....                             |                 | 63.07       |             | .022    |
| Miscellaneous expenses.....          |                 | 73.64       |             | .024    |
| Subsistence.....                     |                 | 1,152.57    |             | .378    |
| Steamboat expenses.....              |                 | 115.86      |             | .038    |
| Labor.....                           |                 | 3,587.42    |             | 1.178   |
| Supervision.....                     |                 | 313.12      |             | .103    |
| Total field cost.....                |                 | 6,103.28    |             |         |

*Paving, rock and concrete (3,040 linear feet or 2,909 squares).*

| Items.                                | Quantity used.  |             | Per square. |        |
|---------------------------------------|-----------------|-------------|-------------|--------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization.....  |                 | \$232.92    |             | \$0.00 |
| Stone..... tons.....                  | 1,885           | 4,284.40    | 2.164       | 4.9    |
| Cement..... sacks.....                | 12,696          | 5,903.28    | 6.234       | 2.8    |
| Sand and gravel..... cubic yards..... | 2,352           | 729.59      | 1.154       | .3     |
| Coal..... tons.....                   | 33.35           | 170.75      | .016        | .00    |
| Oil.....                              |                 | 11.50       |             | .00    |
| Miscellaneous expenses.....           |                 | 821.31      |             | .2     |
| Subsistence.....                      |                 | 927.47      |             | .31    |
| Steamboat expenses.....               |                 | 677.48      |             | .2     |
| Labor.....                            |                 | 2,374.82    |             | .81    |
| Supervision.....                      |                 | 500.01      |             | .17    |
| Total field cost.....                 |                 | 16,633.53   |             |        |

*Summary of costs (3,040 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|--------------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....      | \$5.899          | \$39,985.35 | \$7.722                  | \$22,736.81 | \$62,722.16  | \$20.6                      |
| Office expenses.....       | .087             | 593.78      | .150                     | 437.18      | 930.96       | .3                          |
| Surveys.....               | .059             | 399.85      | .056                     | 163.93      | 563.78       | .1                          |
| Care of plant.....         | .120             | 808.35      | .158                     | 459.65      | 1,268.00     | .4                          |
| Repair of plant.....       | .648             | 4,394.80    | .887                     | 2,581.04    | 6,975.84     | 2.2                         |
| Depreciation of plant..... | .347             | 2,349.14    | .461                     | 1,339.86    | 3,689.00     | 1.2                         |
| Total.....                 | 7.160            | 48,602.87   | 9.434                    | 27,718.47   | 76,149.74    | 25.0                        |

<sup>1</sup> Cost per square completed upper bank work.

*Natchez front.*—No work was done during the year. The expenditures amounting to \$693.64 were for surveys and miscellaneous.

The field work was in charge of Asst. Engineer E. B. Geddes, assisted by Junior Engineer Geo. C. Schoenberger and Supt. J. R. Allen.

*Condition at end of present year.*—In Giles Bend a total of 20,917 linear feet of bank is protected by subaqueous mattress of willow and stone, 17,340 feet of upper bank are paved, and a spur levee 16,621 feet long has been built to commission grade on the axis of Cowpen Neck. Slight caving has occurred in the upper portion of the bend. The work has been successful in preventing a threatened cut-off between Giles and Cowpen Bends, although numerous failures of the revetment have occurred and a considerable portion of the spur levee was destroyed by caving of the bank and had to be replaced. The work, as far as can be determined, is in fairly good condition, except for the caving in the upper portion of the bend. In Marengo Bend the bank has been protected for 12,844 linear feet with a standard revetment, all of which is believed to be in good condition. On the Natchez front the bank has been protected with standard revetment for 3,536 linear feet in two detached pieces: upper 2,136 feet long, and lower 1,400 feet long, separated by an unprotected gap of about 1,600 feet. Further loss of bank on the harbor front has been prevented and the site of the city waterworks preserved. The project for improving the harbors at Natchez and Vidalia, Miss. and La., has not been completed, as the several revetments require further extension as well as maintenance of existing work.

Total expenditures on existing project in Giles Bend were \$1,296,587.54 for new work, and \$438,068.19 for maintenance, making a total of \$1,734,655.73. In Marengo Bend \$381,857 for new work, and \$84,041.02 for maintenance, making a total of \$465,898.02. On the Natchez front \$120,730.26 for new work, and \$5,758.22 for maintenance, making a total of \$126,488.48. Grand total for improving harbors at Natchez, Miss., and Vidalia, La., \$1,799,174.80 for new work

and \$527,867.43 for maintenance, making a grand total of \$2,327,042.23. The project has not yet been completed.

*Local cooperation.*—None.

*Proposed operations.*—To restore to its original length and maintain the revetment in Giles Bend and to maintain the spur levee. To maintain and extend the revetment in Marengo Bend and to close the gap between the upper and lower revetments on the Natchez front.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate and deepen the channel, to protect the banks of the river, to preserve generally the controlling levee line, to prevent a cut-off between Giles and Cowpen Bends, and to preserve the harbor front and waterworks of the city of Natchez.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |                |
|--------------------------------------------|----------------|
| New work.....                              | \$1,799,174.80 |
| Maintenance.....                           | 512,711.07     |
| Total expended.....                        | 2,311,885.87   |
| Total appropriations to June 30, 1917..... | 2,418,500.00   |

| Fiscal year ending June 30.   | 1913         | 1914         | 1915       | 1916        | 1917         |
|-------------------------------|--------------|--------------|------------|-------------|--------------|
| Expended for new work.....    | \$225,280.10 | \$322,165.54 | \$8,373.42 | \$57,485.66 | .....        |
| Expended for maintenance..... | 21,980.70    | 17,153.63    | 56,133.10  | 78,590.61   | \$163,066.76 |
| Total expended.....           | 247,260.80   | 339,319.17   | 64,506.52  | 136,076.27  | 163,066.76   |
| Appropriated or allotted..... | 338,500.00   | 67,000.00    | 183,000.00 | 200,000.00  | .....        |

|                                                                                                           |             |
|-----------------------------------------------------------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended.....                                                                     | \$69,680.89 |
| Amount allotted from river and harbor act approved July 27, 1916..                                        | 200,000.00  |
|                                                                                                           | 269,680.89  |
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... | 163,066.76  |
| July 1, 1917, balance unexpended.....                                                                     | 106,614.13  |
| July 1, 1917, outstanding liabilities.....                                                                | 6,677.50    |
| July 1, 1917, balance available for fiscal year ending June 30, 1918..                                    | 99,936.63   |

*Abstract of appropriations.*

| Act of Congress.                                | Allotted.     | Amount.     |
|-------------------------------------------------|---------------|-------------|
| June 16, 1880 (sundry civil).....               |               | \$40,000.00 |
| Mar. 3, 1881 (river and harbor).....            |               | 50,000.00   |
| July 13, 1892 (river and harbor).....           |               | 80,000.00   |
| Aug. 18, 1894 (sundry civil).....               |               | 80,000.00   |
| June 3, 1896 (river and harbor).....            | June 27, 1896 | 64,000.00   |
| Mar. 3, 1899 (sundry civil).....                | Mar. 13, 1899 | 50,000.00   |
| June 13, 1902 (river and harbor).....           | July 12, 1902 | 60,000.00   |
| Mar. 3, 1903 (sundry civil).....                | July 21, 1903 | 12,000.00   |
| Do.....                                         | Apr. 26, 1905 | 40,000.00   |
| June 30, 1906 (sundry civil).....               | June 28, 1906 | 50,000.00   |
| Mar. 2, 1907 (river and harbor).....            | July 12, 1907 | .....       |
| For Giles Bend.....                             | \$75,000.00   | 165,000.00  |
| For Natchez front.....                          | 190,000.00    |             |
| May 27, 1908 (sundry civil) for Giles Bend..... | May 4, 1907   | 75,000.00   |
| Mar. 4, 1909 (sundry civil).....                | Apr. 28, 1909 | 50,000.00   |
| June 25, 1910 (sundry civil).....               | Apr. 30, 1910 | 44,000.00   |
| June 25, 1910 (river and harbor).....           | July 6, 1910  | 130,000.00  |
| Feb. 27, 1911 (river and harbor).....           | May 3, 1911   | 75,000.00   |
| July 25, 1912 (river and harbor).....           | Aug. 3, 1912  | .....       |
| For Marengo Bend.....                           | \$165,000.00  | 265,000.00  |
| For Giles Bend.....                             | 100,000.00    |             |

<sup>1</sup> Original allotment, \$100,000; \$10,000 transferred to Atchafalaya and Red Rivers, La.

*Abstract of appropriations—Continued.*

| Act of Congress.                                                                       | Allotted.     | Amount.                 |
|----------------------------------------------------------------------------------------|---------------|-------------------------|
| Mar. 4, 1913 (river and harbor).....                                                   | Apr. 30, 1913 |                         |
| For Marengo Bend.....                                                                  |               |                         |
| For Giles Bend.....                                                                    |               | \$338,500.00            |
| Oct. 2, 1914 (river and harbor).....                                                   | Oct. 15, 1914 | 10,000.00               |
| Mar. 4, 1915 (river and harbor).....                                                   | Apr. 18, 1915 | <sup>2</sup> 183,000.00 |
| July 27, 1916 (river and harbor).....                                                  | Aug. 14, 1916 |                         |
| For Marengo Bend.....                                                                  |               | 200,000.00              |
| For Giles Bend.....                                                                    |               |                         |
|                                                                                        |               | 2,061,500.00            |
| PREVENTION OF CUT-OFF AT GILES BEND.                                                   |               |                         |
| June 4, 1897 (sundry civil).....                                                       | July 10, 1897 | <sup>3</sup> 110,000.00 |
| June 6, 1900 (sundry civil).....                                                       | July 14, 1900 | 150,000.00              |
|                                                                                        |               | 260,000.00              |
| EMERGENCIES IN RIVER AND HARBOR WORKS—ALLOTMENT FOR "MISSISSIPPI RIVER AT GILES BEND." |               |                         |
| Apr. 28, 1904 (sundry civil).....                                                      | July 6, 1904  | 40,000.00               |
| Oct. 2, 1914 (river and harbor).....                                                   | Oct. 15, 1915 |                         |
| For Marengo Bend.....                                                                  |               |                         |
| For Giles Bend.....                                                                    |               | <sup>4</sup> \$5,000.00 |
| For Natchez front.....                                                                 |               | 40,000.00               |
|                                                                                        |               | 57,000.00               |
| Grand total.....                                                                       |               | 2,418,500.00            |

<sup>1</sup> Original allotment, \$244,000; \$10,500 transferred to Bondurant and \$10,000 to Giles Bend.

<sup>2</sup> By transfer, \$123,000.

<sup>3</sup> Original allotment, \$150,000; \$40,000 transferred to harbor at New Orleans.

<sup>4</sup> Original allotment, \$15,000; \$10,000 transferred to Natchez and Vidalia Harbors, Miss. and La.

*Contracts in force.*—None.

(c) *Junction of the Mississippi, Red, and Atchafalaya Rivers.*

*Location.*—Seven hundred and sixty-four miles below Cairo, right bank.

*Original condition.*—Prior to 1831, the Red River entered the Mississippi and the Atchafalaya flowed out from the Mississippi near the apex of a long horse-shoe-shaped bend. In 1831 the Shreve cut-off was made across the narrow part of the peninsula forming the interior of the horseshoe bend, and left the mouth of Red and head of the Atchafalaya in a lake with a precarious and uncertain connection with the Mississippi River. In the course of time, the entrance to and channel through this lake, known as Old River, became greatly obstructed during low water by sand bars and shoals. In addition to this, the channel of the Atchafalaya, forced to carry all of Red River, augmented during floods in the Mississippi by water from the latter stream, commenced to enlarge with great rapidity, until there was an apprehension that the Mississippi would desert its present channel and flow to the Gulf of Mexico via the Atchafalaya.

*Previous projects.*—The project adopted by act of June 18, 1878, provided for maintaining a navigable channel during low water between the Mississippi, Red, and Atchafalaya by means of dredging and washing the channel with tugboats and a sternwheel steamboat. The act of August 2, 1882, transferred the supervision of the work to the Mississippi River Commission. The modified project adopted in 1896-97, provided for the construction of six low relief dams across the Atchafalaya near Simmesport, La., to prevent the further enlargement of that stream; the construction of a dam across Old River between the mouth of Red and head of the Atchafalaya; the reopening of a channel to the Mississippi River by way of Upper Old River, and the maintenance of navigation during low water by dredging. In 1897 this project was modified to provide only for the maintenance of navigation by dredging, and for maintenance of the sill dams already built, Nos. 1 and 3. Prior to 1897, the dam across Old River had been destroyed, first by making a cut through it and subsequently by the current of the river.

*Present project.*—The present project, adopted in 1897 by the Mississippi River Commission, provides for the securing of low-water navigation between the Mississippi, Red, and Atchafalaya Rivers by dredging; the maintenance of

sill dams Nos. 1 and 3 in the Atchafalaya; and to repair, care for, and improve the hydraulic dredge, *The Ram*, belonging to the work.

*Operations and results prior to the present year.*—The maintenance of low-water navigation between the Mississippi, Red, and Atchafalaya Rivers by various means of dredging was prosecuted with varying degrees of success until 1893, since which time operations have been successful, due to the efficiency of the dredge *The Ram*, constructed in that year. Two sill dams, Nos. 1 and 3, had been placed in the Atchafalaya just below the mouth of Bayou des Glaizes, and a dam across Old River between the mouth of Red and head of the Atchafalaya had been built, but was afterwards cut. Some work in the direction of opening up Upper Old River was done. The effect of the work was to secure uninterrupted low-water navigation since 1893, and to prevent the further enlargement of the Atchafalaya. Amounts spent for original work and for maintenance were \$672,332.35 and \$601,086.99, respectively, a total of \$1,273,419.34.

*Operations and results during the present year.*—The subproject for work was to do such dredging as might be necessary to maintain low-water navigation between the Mississippi, Red, and Atchafalaya Rivers through Lower Old River, to repair and maintain the sill dams in the Atchafalaya and to repair and care for the hydraulic dredge, *The Ram*. All work was done by day labor.

The river having fallen to a stage of 16 feet on the Red River Landing gauge, and there being but 9 feet of water in the channel over the bar at the entrance to Old River, dredging by the hydraulic dredge *The Ram* was commenced August 21, 1916, and continued with short intermissions until October 28, 1916, by which time a rise in the Mississippi rendered further dredging unnecessary. Navigation was not obstructed during the year. The lowest reading of the Red River Landing gauge was 5.4 feet. The total length of the channel dredged was 1,260 feet, and the total excavation was about 100,418 cubic yards. During the year 54 pontoons were built, a new dredging pump was installed, and the dredge fitted with a new suction and discharge pipe, new smoke stacks, and other repairs. The dredge was also operated at Memphis, Tenn., and on a hydraulic fill at Grand Bay, La.

So far as is known, the sill dams in the Atchafalaya remain in good condition.

The usual hydrographic survey of Old River and over the sill dams in the Atchafalaya has been made. The results show a continued enlargement of Old River and marked scour above, between, and below the sills, due to the extreme flood of 1916. The cost of survey work was \$2,051.43.

Tables of average areas and widths, maximum and means depths of Old River, referred to a plane 35 feet above the zero of the Barbres gauge, have been compiled and are consolidated and tabulated as follows:

## COMPARISONS, 1894 AND 1915.

|               | Average<br>area. | Average<br>width. | Average<br>maxi-<br>mum<br>depth. | Average<br>mean<br>depth. |
|---------------|------------------|-------------------|-----------------------------------|---------------------------|
|               | <i>Sq. ft.</i>   | <i>Feet.</i>      | <i>Feet.</i>                      | <i>Feet.</i>              |
| 1894.....     | 20,933           | 792               | 46.8                              | 26.7                      |
| 1915.....     | 27,201           | 784               | 55.7                              | 34.8                      |
| Increase..... | 6,268            | 18                | 8.9                               | 8.1                       |

## COMPARISONS, 1915 AND 1916.

|               | 27,201 | 784 | 55.7 | 34.8 |
|---------------|--------|-----|------|------|
|               | 29,146 | 792 | 59.3 | 36.9 |
| Increase..... | 1,945  | 8   | 3.6  | 2.1  |

<sup>1</sup> Decrease.

The field work was in charge of Asst. Engineer H. S. Douglas.

The amount expended from June 1, 1916, to May 31, 1917, is \$22,390.21, distributed as follows:

|                       |          |
|-----------------------|----------|
| Dredging              | \$7,352. |
| Surveys               | 2,051.   |
| Equipment             | 885.     |
| Repairs to plant      | 11,353.  |
| Overhead              | 747.     |
| Total                 | 22,390.  |
| Depreciation of plant | 757.     |
| Gross total           | 23,147.  |

*Condition at end of present year.*—The work consists of two large brush and stone sill dams in the Atchafalaya to restrict its outlet capacity, and the maintenance by dredging of low-water navigation between the Mississippi, Red, and Atchafalaya Rivers. The work has been successful, and the sill dams, so far as is known, are in good condition. The work is not susceptible of permanent completion, as annual dredging at low water is necessary to remove the deposits made during high water and the sill dams will have to be maintained.

Total expenditures on existing project were \$672,332.35 for new work and \$623,477.30 for maintenance, making a total of \$1,295,809.65. The project is not susceptible of completion.

*Local cooperation.*—Prior to the United States assuming charge of this work in 1878, the State of Louisiana had endeavored to maintain navigation. Owing to lapse of time, the amount expended by the State is unobtainable.

*Proposed operations.*—To secure low-water navigation by means of dredging and to maintain the sill dams in the Atchafalaya.

*Effect of improvement.*—Low-water navigation between the Mississippi, Red, and Atchafalaya has been maintained, and the further enlargement of the Atchafalaya has been prevented.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                       |              |
|---------------------------------------|--------------|
| New work                              | \$672,332.35 |
| Maintenance                           | 608,234.15   |
| Total expended                        | 1,280,566.50 |
| Total appropriations to June 30, 1917 | 1,280,790.00 |

| Fiscal year ending June 30. | 1913        | 1914       | 1915       | 1916        | 1917        |
|-----------------------------|-------------|------------|------------|-------------|-------------|
| Expended for maintenance    | \$15,953.14 | \$7,668.23 | \$5,990.72 | \$34,731.15 | \$21,977.30 |
| Appropriated or allotted    |             | 25,000.00  | 20,000.00  | 15,000.00   |             |

July 1, 1916, balance unexpended \$7,200.80  
 Amount allotted from river and harbor act approved July 27, 1916 15,000.00

22,200.80

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance 21,977.30

July 1, 1917, balance unexpended 223.40  
 July 1, 1917, outstanding liabilities 10.20

July 1, 1917, balance available for fiscal year ending June 30, 1918 213.20

*Abstract of appropriations.*

| Act of Congress.                                 | Allotted.        | Amount.                 |
|--------------------------------------------------|------------------|-------------------------|
| June 18, 1878 (river and harbor).....            |                  | \$150,000.00            |
| Mar. 3, 1879 (sundry civil).....                 |                  | 40,000.00               |
| July 5, 1884 (river and harbor).....             | Aug. 5, 1884     | <sup>1</sup> 11,390.00  |
| Do.....                                          | ( <sup>2</sup> ) | 10,500.00               |
| Do.....                                          | ( <sup>2</sup> ) | 1,400.00                |
| Do.....                                          | Aug. 19, 1884    | 15,000.00               |
| RECTIFICATION OF RED AND ATCHAFALAYA RIVERS.     |                  | 228,290.00              |
| Aug. 5, 1886 (river and harbor).....             |                  | 187,500.00              |
| Aug. 11, 1888 (river and harbor).....            |                  | 250,000.00              |
| Sept. 19, 1890 (river and harbor).....           | Oct. 15, 1890    | <sup>3</sup> 217,000.00 |
| Do.....                                          | ( <sup>2</sup> ) | 3,000.00                |
| July 13, 1892 (river and harbor).....            |                  | 80,000.00               |
| Aug. 18, 1894 (sundry civil).....                |                  | <sup>4</sup> 70,000.00  |
| June 3, 1896 (river and harbor).....             | June 27, 1896    | 40,000.00               |
| Mar. 3, 1899 (sundry civil).....                 | Mar. 13, 1899    | 25,000.00               |
| June 13, 1902 (river and harbor).....            | July 12, 1902    | 15,000.00               |
| Do.....                                          | Oct. 17, 1904    | 1,000.00                |
| Mar. 3, 1905 (sundry civil).....                 | Apr. 26, 1905    | 24,000.00               |
| May 27, 1908 (sundry civil).....                 | Nov. 3, 1908     | ( <sup>6</sup> )        |
| Do.....                                          | ( <sup>2</sup> ) | 10,000.00               |
| Mar. 4, 1909 (sundry civil).....                 | Apr. 28, 1909    | 25,000.00               |
| June 25, 1910 (sundry civil).....                | Apr. 30, 1910    | <sup>6</sup> 15,000.00  |
| July 25, 1912 (river and harbor).....            | Aug. 3, 1912     | 10,000.00               |
| Mar. 4, 1913 (river and harbor).....             | Apr. 30, 1913    | 10,000.00               |
| Do.....                                          | ( <sup>2</sup> ) | 10,000.00               |
| July 27, 1916 (river and harbor).....            | Aug. 14, 1916    | 15,000.00               |
| EMERGENCIES IN RIVER AND HARBOR WORKS—OLD RIVER. |                  | 1,007,500.00            |
| Mar. 3, 1905 (river and harbor).....             | Oct. 5, 1908     | 6,000.00                |
| Do.....                                          | Nov. 12, 1908    | 4,000.00                |
|                                                  |                  | 10,000.00               |
| Oct. 2, 1914 (river and harbor).....             | Oct. 15, 1914    | 15,000.00               |
| Mar. 4, 1915 (river and harbor).....             | Apr. 18, 1915    | <sup>7</sup> 20,000.00  |
|                                                  |                  | 35,000.00               |
| Grand total.....                                 |                  | 1,280,790.00            |

<sup>1</sup> Original allotment, \$12,290; \$900 transferred to harbor at New Orleans.

<sup>2</sup> By transfer.

<sup>3</sup> Original allotment, \$225,000; \$8,000 transferred to harbor at New Orleans.

<sup>4</sup> \$2,500 expended improving Bayou des Glaizes.

<sup>5</sup> Original allotment, \$1,500; transferred to plant, fourth district.

<sup>6</sup> Original allotment, \$25,000; \$10,000 transferred to Kempe Bend revetment.

<sup>7</sup> Original allotment, \$30,000; \$10,000 transferred to Baratavia levee district.

*Contracts in force.*—None.

(f) *Grand Bay.*

*Location.*—Eight hundred and eight miles below Cairo, right bank.

*Original condition.*—Caving of the river banks at this locality had been in progress for many years, but the exact date is unknown. Within recent years caving became more and more active until the dikes (levees) across the lower end of False River were threatened. The destruction of these dikes would have probably entailed the building of a long and costly line of levee around False River and the abandonment to overflow of a large area of cultivated land.

*Previous projects.*—None.

*Present project.*—The project adopted August 21, 1916, provides for the protection of the caving bank for a distance of about 10,000 linear feet with mattresses 400 feet wide of brush and stone, the upper bank to be graded to a slope of at least 1 in 4 and paved with rock to the top of the bank.

*Operations and results prior to the present year.*—None.

*Operations and results during the present year.*—The work originally projected for the present year was torevet the caving bank at Grand Bay for a distance of 5,000 linear feet with mattresses 300 feet wide and the conventional upper-bank grading and paving. The project was drawn while the sur-

vey was in progress. When the survey was platted unusual conditions were found to exist, the line of deepest water being much farther away from the bank than had been anticipated. A revision of the project became necessary and as finally executed provided for mattresses 400 feet wide, the grading of the upper bank to a slope of at least 1 in 4, and paving to the top of the bank. This work was much more expensive than that originally projected and the length of revetted bank had to be reduced. The upper bank was the most troublesome this district has had to deal with, that portion near the water edge being composed of quicksand or ooze that would not support the weight of the rock pavement. As a result a mattress had to be built to cover the quicksand and the rock pavement laid over it. Construction of mattress was commenced October 19, 1916. Sinking of mattresses 400 feet wide was commenced November 20, 1916, and completed December 30, 1916. The paving of the upper bank was delayed by scarcity of rock, due to the nation-wide shortage, and was not completed until January 28, 1917. The pavement was in places 236 feet wide and nowhere less than 105 feet. All work was done by hired labor with Government plant.

A total of 10,542 squares of mattress were placed and 5,027 squares of upper bank were paved. The revetment was 3,180 linear feet in length, and the detailed cost is set forth in the accompanying tables:

## GRAND BAY (FOURTH DISTRICT).

*Mattresses, total area 10,541.9 squares (channel mats, 100 per cent).*

## BUILDING MATS.

| Items.                                | Quantity used.  |             | Per square. |        |
|---------------------------------------|-----------------|-------------|-------------|--------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization ..... |                 | \$1,114.60  |             | \$0.17 |
| 9-inch nails .....                    | pounds.. 15,800 | 581.90      | 1.5         | .02    |
| 6-inch nails .....                    | do. 28,500      | 932.79      | 2.72        | .01    |
| 4-inch nails .....                    | do. 6,800       | 200.60      | .66         | .00    |
| Lumber .....                          | 511,878         | 7,996.24    | 48.56       | .75    |
| Wire, No. 10 .....                    | pounds.. 12,600 | 472.50      | 1.20        | .08    |
| Treenails, 1-inch .....               | number. 12,000  | 51.00       | 1.17        | .08    |
| Treenails, $\frac{3}{4}$ -inch .....  | do. 73,500      | 157.00      | 7.0         | .09    |
| Brush and poles .....                 | cords.. 10,850  | 7,805.78    | 1.03        | .71    |
| Rope, manila .....                    | pounds.. 2,825  | 504.25      | .27         | .08    |
| Oil .....                             |                 | 121.60      |             | .05    |
| Miscellaneous expenses .....          |                 | 690.86      |             | .05    |
| Subsistence .....                     |                 | 3,033.63    |             | .23    |
| Steamboat expenses .....              |                 | 2,823.00    |             | .22    |
| Labor .....                           |                 | 5,479.37    |             | .57    |
| Supervision .....                     |                 | 1,626.51    |             | .15    |
| Total field cost .....                |                 | 33,596.63   |             |        |

## BALLASTING AND SINKING.

|                                       |                 |            |      |        |
|---------------------------------------|-----------------|------------|------|--------|
| Mobilization and demobilization ..... |                 | \$1,827.43 |      | \$0.18 |
| $\frac{5}{8}$ -inch strand .....      | pounds.. 7,290  | 367.20     | 0.7  | .01    |
| 9-inch nails .....                    | do. 3,600       | 118.80     | .34  | .01    |
| 6-inch nails .....                    | do. 3,500       | 115.50     | .33  | .01    |
| 4-inch nails .....                    | do. 400         | 13.20      | .04  | .00    |
| Lumber .....                          | 24,374          | 347.33     | 2.3  | .09    |
| Wire, No. 10 .....                    | pounds.. 4,000  | 140.00     | .38  | .04    |
| Clips, $\frac{1}{4}$ -inch .....      | 126             | 9.45       | .012 | .00    |
| Stone .....                           | tons.. 8,016.74 | 17,591.13  | .76  | 1.66   |
| Rope, manila .....                    | pounds.. 2,825  | 504.25     | .27  | .04    |
| Oil .....                             |                 | 30.92      |      | .00    |
| Miscellaneous expenses .....          |                 | 1,051.08   |      | .08    |
| Subsistence .....                     |                 | 4,418.64   |      | .4     |
| Steamboat expenses .....              |                 | 2,011.00   |      | .18    |
| Labor .....                           |                 | 6,225.17   |      | .59    |
| Supervision .....                     |                 | 782.39     |      | .07    |
| Total field cost .....                |                 | 35,553.49  |      |        |

*Grading (5,027.6 squares).*

| Items.                      | Quantity used.  |             | Per square. |          |
|-----------------------------|-----------------|-------------|-------------|----------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.    |
| Cope, manila.....pounds..   | 565             | \$100.85    | 0.112       | \$0.0200 |
| Coal.....tons..             | 367.2           | 1,468.80    | .073        | .2921    |
| Oil.....                    |                 | 109.17      |             | .0209    |
| Miscellaneous expenses..... |                 | 523.35      |             | .0005    |
| Subsistence.....            |                 | 1,302.41    |             | .2749    |
| Steamboat expenses.....     |                 | 164.00      |             | .0326    |
| Labor.....                  |                 | 5,390.71    |             | 1.0722   |
| Supervision.....            |                 | 647.00      |             | .1287    |
| Total field cost.....       |                 | 9,786.29    |             |          |

*Paving, rock and concrete (5,027.6 squares).*

| Items.                      | Quantity used.  |             | Per square. |          |
|-----------------------------|-----------------|-------------|-------------|----------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.    |
| Stone.....tons..            | 11,407.29       | \$25,031.02 | 2.27        | \$4.9787 |
| Cope, manila.....pounds..   | 2,825           | 504.21      | .56         | .1003    |
| Oil.....                    |                 | 10.00       |             | .0019    |
| Miscellaneous expenses..... |                 | 829.46      |             | .1649    |
| Subsistence.....            |                 | 1,648.18    |             | .3278    |
| Steamboat expenses.....     |                 | 781.00      |             | .1565    |
| Labor.....                  |                 | 6,818.92    |             | 1.3563   |
| Supervision.....            |                 | 760.10      |             | .1512    |
| Total field cost.....       |                 | 36,382.89   |             |          |

*Summary of costs (3,180 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....      | \$6.56           | \$69,150.12 | \$9.18           | \$46,169.18 | \$115,319.30 | \$36.26                     |
| Office expenses.....       | .08              | 839.65      | .11              | 559.77      | 1,399.42     | .44                         |
| Surveys.....               | .07              | 790.30      | .10              | 530.86      | 1,327.16     | .42                         |
| Repair of plant.....       | .16              | 1,762.80    | .23              | 1,175.20    | 2,938.00     | .92                         |
| Repair of plant.....       | .93              | 9,862.13    | 1.11             | 6,574.76    | 16,436.89    | 5.17                        |
| Depreciation of plant..... | .36              | 3,786.00    | .50              | 2,524.00    | 6,310.00     | 1.98                        |
| Total.....                 | 8.16             | 86,197.00   | 11.23            | 57,533.77   | 143,730.77   | 45.19                       |

The field work was in charge of Asst. Engineer H. S. Douglas, assisted by Junior Engineers G. D. Waddill and John W. Whitty.

*Condition at end of present year.*—A total of 3,180 linear feet of bank is protected with mattresses 400 feet wide, and a pavement of rock extending to the top of the bank. Over the stretch thus protected the bank has been made reasonably permanent and the dikes across Grand Bay and Hermitage (lower end of False River) preserved. So far as is known, the work is in good condition. The project is not completed. Total expenditures on existing project were \$141,003.63 for new work.

*Local cooperation.*—None.

*Proposed operations.*—To extend the existing revetment.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate and deepen the channel, to protect the banks of the river and preserve the dikes across the lower end of False River.

## FINANCIAL SUMMARY.

|                                                                                                                            |             |
|----------------------------------------------------------------------------------------------------------------------------|-------------|
| Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included, new work----- | \$142, 565. |
| Total appropriations to June 30, 1917-----                                                                                 | 175, 000.   |
| Fiscal year ending June 30, 1917, expended for new work-----                                                               | 142, 565.   |
| Appropriated or allotted, 1916-----                                                                                        | 175, 000.   |
| Amount allotted from river and harbor act approved July 27, 1916                                                           | 175, 000.   |
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for new work-----                     | 142, 565.   |
| July 1, 1917, balance unexpended-----                                                                                      | 32, 434.    |
| July 1, 1917, outstanding liabilities-----                                                                                 | 432.        |
| July 1, 1917, balance available for fiscal year ending June 30, 1918                                                       | 32. 002.    |

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.     | Amount.   |
|---------------------------------------|---------------|-----------|
| July 27, 1916 (river and harbor)----- | Aug. 14, 1916 | \$175,000 |

*Contracts in force.*—None.

*(g) Plaquemine, La.*

*Location.*—Eight hundred and fifty-four miles below Cairo, right bank.

*Original condition.*—Caving in this bend has been in progress from an early date, probably for 100 years or more, but the exact date is unknown. The caving had destroyed a considerable portion of the town of Plaquemine, together with several lines of levee, and threatened the Government lock at the head of Bayou Plaquemine. The bend was peculiar, inasmuch as caves subsidence of enormous extent occurred at intervals without warning.

*Previous projects.*—The work originated under the river and harbor act August 11, 1888, which provided for “\* \* \* securing a navigable channel 100 feet wide and 6 feet in depth, from deep water up to Plaquemine Diike, and for securing the mouth of the bayou from further caving.” The project provided for the construction of four submerged sloping spur dikes of brush and stone, placed at intervals of about 1,000 feet. In 1893 the project was modified to provide for continuous revetment of the bank with mattresses of willow brush. Up to 1902 five spur dikes had been constructed and the intervals between extensively mattressed, at a cost of \$258,516.22. Operations were suspended until 1911, when the Mississippi River Commission assumed charge of the work.

*Present project.*—The project adopted in 1911 provides for a continuous standard revetment of the bank in front of the Government lock and the town of Plaquemine with mattresses 400 feet wide, together with upper-bank grading and paving.

*Operations and results prior to the present year.*—Under the existing project a total of 6,370 linear feet of bank has been protected with mattresses 400 feet wide and the upper bank paved with rock. A cave occurred on December 1, 1912, destroying 750 linear feet of the revetment, as well as the controlling levee line and a small portion of the town of Plaquemine. This cave has been replaced. The amounts spent for original work and for maintenance prior to the beginning of the present year were \$189,688.32 and \$36,837.01, respectively, a total of \$226,525.33. The work has been successful in preserving the Government lock. The project is completed, only annual maintenance being required.

*Operations and results during the present year.*—During September and October, 1916, a careful hydrographic survey was made over the protected bank. This survey developed the following conditions: A cave of the unprotected bank above had flanked and destroyed the revetment for a distance of about 500 feet by flanking. A subaqueous cave had occurred in front of the lock, apparently destroying the mattress work for a distance of over 700 feet. The cave of December, 1912, had subsided about 6 feet without apparent injury to the mattress work in front. It was planned to repair the injured revetment in front

of the lock, so far as existing funds would permit. The necessary mattresses were built, but before they could be sunk in place the river rose to a stage that rendered it impracticable to place them, and they were diverted to New Orleans Harbor. The funds expended were principally for the survey and amounted to \$1,859.85. There is material on hand for future construction valued at \$4,194.07.

*Condition at end of present year.*—A total of 6,370 linear feet of bank, including the Government lock and the town of Plaquemine, has been protected with a standard revetment of willow mattresses and stone. Over the stretch thus protected the bank has been made reasonably permanent and the Government lock has been preserved. The work is not in good condition, several caves having occurred, which have not been repaired. The project has been completed, but annual maintenance will be required.

Total expenditures on existing project were \$189,688.32 for new work and \$38,696.86 for maintenance, making a total of \$228,385.18.

*Local cooperation.*—None.

*Proposed operations.*—To maintain existing work.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river, and to preserve the Government lock and the town of Plaquemine, La.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                       |              |
|---------------------------------------|--------------|
| New work                              | \$189,688.32 |
| Mainenance                            | 38,696.86    |
| Total expended                        | 228,385.18   |
| Total appropriations to June 30, 1917 | 230,000.00   |

| Fiscal year ending June 30. | 1913        | 1914        | 1915        | 1916        | 1917       |
|-----------------------------|-------------|-------------|-------------|-------------|------------|
| Expended for new work       | \$47,539.72 | \$35,738.53 | \$33,639.83 | \$26,566.92 | .....      |
| Expended for maintenance    | 4,349.09    | .....       | 7,897.59    | 24,590.33   | \$1,859.85 |
| Total expended              | 51,888.81   | 35,738.53   | 41,537.42   | 51,157.25   | 1,859.85   |
| Appropriated or allotted    | 50,000.00   | 50,000.00   | 30,000.00   | .....       | .....      |

|                                                                                                      |            |
|------------------------------------------------------------------------------------------------------|------------|
| July 1, 1916, balance unexpended                                                                     | \$3,474.67 |
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance | 1,859.85   |
| July 1, 1917, balance unexpended                                                                     | 1,614.82   |
| July 1, 1917, balance available for fiscal year ending June 30, 1918                                 | 1,614.82   |

*Abstract of appropriations.*

| Act of Congress.                 | Allotted.     | Amount.     |
|----------------------------------|---------------|-------------|
| Feb. 27, 1911 (river and harbor) | May 3, 1911   | \$50,000.00 |
| July 25, 1912 (river and harbor) | Aug. 3, 1912  | 50,000.00   |
| Mar. 4, 1913 (river and harbor)  | Apr. 30, 1913 | 50,000.00   |
| Oct. 2, 1914 (river and harbor)  | Oct. 15, 1914 | 50,000.00   |
| Mar. 4, 1915 (river and harbor)  | Apr. 18, 1915 | 130,000.00  |
| Total                            |               | 230,000.00  |

<sup>1</sup> Original allotment \$50,000; \$10,000 transferred to Lower Tensas levee district and \$10,000 transferred to Atchafalaya levee district.

*Contracts in force.*—None.

*(h) Harbor at New Orleans, La.*

*Location.*—Nine hundred and sixty-five miles below Cairo, right and left banks.

*Original condition.*—As far back as authentic records exist, the river banks in the concave bends of the river comprised in New Orleans Harbor have been caving, destroying wharves, levees, railroad terminals, and other works of public improvement, thus obstructing commerce.

*Previous projects.*—In 1878 a mixed board of army and civil engineers was convened to examine and report on the means necessary to protect the wharves and harbor from the incursions of the river. By act of June 18, 1878, Congress made an appropriation to begin the work. The approved project contemplated the protection of the caving banks in the Third District Reach with mattresses constructed of fish-pole cane. Work was prosecuted until September 29, 1881, when the project was definitely abandoned, after an expenditure of \$114,564.72.

*Present project.*—The act of August 2, 1882, placed the work under the supervision of the Mississippi River Commission, which, on September 18, 1882, adopted a project providing for the protection of the caving bank in the Carrollton Bend with continuous mattresses of willow brush. In 1884 the project was modified to provide, in addition, for submerged sloping spur dikes of brush and stone, and the scope of the work was extended to cover the Gouldsboro Bend. In 1889 the work was extended to cover the Greenville Bend and the Third District Reach. The present project, as modified, provides for both spur dikes and continuous mattress revetment.

*Operations and results prior to the present year.*—The river banks have been protected as follows: In Carrollton Bend for 11,295 feet by continuous mattress, and for 2,335 feet by five spur dikes in conjunction with continuous mattresses. In Greenville Bend, near Amesville, for 11,810 feet, and at Westwego for 1,500 feet by continuous mattress. On the Gretna Front for 5,010 feet by continuous mattress. In the Gouldsboro Bend for 9,475 feet by a combination of 24 submerged sloping spur dikes and continuous revetment and in the Third District Reach for 1,110 feet by continuous mattress, and for 12,590 feet by continuous mattress in conjunction with 16 submerged sloping dikes. A total of 55,125 linear feet was thus protected. Amounts spent for original work and for maintenance prior to the beginning of the present year were \$1,869,458.86 and \$237,614.39, respectively, a total of \$2,107,073.25. The work has been successful generally in preventing further caving of the banks over the stretches protected. The project is not yet completed, requiring the closure of the unprotected gap in the Greenville Bend and the probable placing of mattresses in the intervals between the spur dikes in the Gouldsboro Bend, together with annual maintenance of the great length of work now in place.

*Operations and results during the present year.*—Surveys of the Gouldsboro Bend and of the Third District Reach were made. No marked changes were developed. The work of the present year was done under many disadvantages. Some mattresses originally built for Plaquemine, La., could not be successfully sunk at that locality and were brought to New Orleans. They were sunk with considerable difficulty in the intervals between spurs 7 and 8 and 11 and 12 of the Gouldsboro series. Work was commenced January 25, 1917, and completed February 10, 1917. A total of 1,800 squares were sunk. Work was done by hired labor with Government plant. Operations were carried on during high water, and this, together with the small amount of work, made costs relatively high, as may be seen from the following tables:

## NEW ORLEANS HARBOR, FOURTH DISTRICT.

*Mattresses, total area 1,800 squares (channel mats, 100 per cent).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |          |
|--------------------------------------|-----------------|-------------|-------------|----------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.    |
| Mobilization and demobilization..... |                 | \$381.40    |             | \$0.2120 |
| 1-inch nails.....pounds..            | 2,700           | 82.35       | 1.5         | .0458    |
| 1-inch nails.....do.....             | 4,900           | 100.55      | 2.72        | .0559    |
| 1-inch nails.....do.....             | 1,200           | 35.40       | .666        | .02      |
| umber.....                           | 76,632          | 1,178.01    | 42.57       | .6550    |
| Wire, No. 10.....pounds..            | 1,600           | 60.00       | .89         | .0333    |
| Greenails, 3/4-inch.....number..     | 12,600          | 25.20       | 7.0         | .0140    |
| Greenails, 1-inch.....do.....        | 1,620           | 6.89        | .9          | .0038    |
| Brush and poles.....cords..          | 1,860           | 1,144.68    | 1.03        | .6360    |
| Rope, manila.....pounds..            | 624             | 112.22      | .35         | .06      |
| Oil.....                             |                 | 240.74      |             | .1337    |
| Miscellaneous expenses.....          |                 | 151.12      |             | .1463    |
| Subsistence.....                     |                 | 816.64      |             | .4540    |
| Teamboat expenses.....               |                 | 1,474.00    |             | .8190    |
| Labor.....                           |                 | 1,753.09    |             | .9740    |
| Supervision.....                     |                 | 601.10      |             | .3340    |
| Total field cost.....                |                 | 8,163.39    |             |          |

## BALLASTING AND SINKING.

|                                      |          |          |      |          |
|--------------------------------------|----------|----------|------|----------|
| Mobilization and demobilization..... |          | \$632.88 |      | \$0.3517 |
| 1-inch strand.....pounds..           | 810      | 40.80    | 0.45 | .0227    |
| 1-inch nails.....do.....             | 600      | 19.80    | .33  | .0110    |
| 1-inch nails.....do.....             | 600      | 19.80    | .33  | .0110    |
| 1-inch nails.....do.....             | 200      | 6.60     | .11  | .0037    |
| umber.....                           | 2,340    | 33.34    | 1.30 | .0185    |
| Wire, No. 10.....pounds..            | 900      | 29.25    | .50  | .0163    |
| Clips, 3/4-inch.....number..         | 24       | 1.80     | .013 | .0010    |
| Stone.....tons.....                  | 1,359.30 | 2,038.95 | .755 | 1.1328   |
| Rope, manila.....pounds..            | 956      | 172.16   | .53  | .096     |
| Oil.....                             |          | 12.87    |      | .0072    |
| Miscellaneous expenses.....          |          | 207.89   |      | .2111    |
| Subsistence.....                     |          | 771.78   |      | .4287    |
| Teamboat expenses.....               |          | 1,067.00 |      | .5928    |
| Labor.....                           |          | 2,519.49 |      | 1.3992   |
| Supervision.....                     |          | 445.18   |      | .2473    |
| Total field cost.....                |          | 8,019.59 |      |          |

*Summary of costs (600 linear feet revetted).*

|                            | Subaqueous work. |             | Total cost per linear foot. |
|----------------------------|------------------|-------------|-----------------------------|
|                            | Per square.      | Total.      |                             |
| Total field cost.....      | \$8.99           | \$16,182.98 | \$26.97                     |
| Office expenses.....       | .76              | 1,375.45    | 2.29                        |
| Surveys.....               | .05              | 83.69       | .14                         |
| Care of plant.....         | .16              | 285.00      | .48                         |
| Repair of plant.....       | 1.14             | 2,046.84    | 3.41                        |
| Depreciation of plant..... | 1.40             | 2,524.32    | 4.21                        |
| Total.....                 | 12.50            | 22,498.28   | 34.50                       |

## Data for cost of revetment, June 1, 1916, to May 31, 1917.

| Location.            | Expended as per financial statement. | Debits to material on hand. | Credit by material on hand. | Total field cost. | Unit field cost.         |                  | Unit overhead cost. |                  | Work accomplished.    |              | Total cost of work. | Gross unit cost. <sup>1</sup> |                  | Remarks.                                                                           |
|----------------------|--------------------------------------|-----------------------------|-----------------------------|-------------------|--------------------------|------------------|---------------------|------------------|-----------------------|--------------|---------------------|-------------------------------|------------------|------------------------------------------------------------------------------------|
|                      |                                      |                             |                             |                   | Per square. <sup>2</sup> | Per linear foot. | Per square.         | Per linear foot. | Squares. <sup>3</sup> | Linear feet. |                     | Per square.                   | Per linear foot. |                                                                                    |
| Hard Times Bend..... | \$52,988.80                          | \$2,960.10                  | \$18,113.11                 | \$34,893.69       | \$6.820                  | \$10.970         | \$0.48              | \$0.76           | 4,906                 | 3,050        | \$37,266.80         | \$7.60                        | \$12.22          | Financial statement includes \$568.99 expended on clearing for next season's work. |
| Bondurant Chute..... | 18,209.50                            | .....                       | 4,543.00                    | 13,001.63         | 9.320                    | 15.855           | .48                 | .81              | 1,395                 | 820          | 13,666.50           | 9.80                          | 16.67            | Financial statement includes \$486.77 expended on clearing for next season's work. |
| Kempe Bend.....      | 54,701.33                            | 9,811.26                    | 13,723.05                   | 48,660.75         | 6.702                    | 19.569           | .37                 | 1.01             | 7,113                 | 2,463        | 50,302.77           | 7.07                          | 20.65            |                                                                                    |
| Giles Bend.....      | 102,964.27                           | { 4,740.68<br>+15,740.00 }  | 3,894.21                    | 82,931.10         | 6.514                    | 20.261           | .35                 | 1.09             | 12,503                | 4,020        | 87,297.32           | 6.98                          | 21.71            | Financial statement includes cost of levee, amounting to \$32,253.42.              |
| Marengo Bend.....    | 59,437.96                            | 45,347.29                   | 565.35                      | 63,285.94         | 6.474                    | 20.632           | .10                 | .36              | 9,688                 | 3,040        | 64,216.90           | 6.63                          | 21.12            | Subaqueous revetment 400 feet wide. Paving carried to top of bank.                 |
| Grand Bay.....       | 141,090.75                           | .....                       | 23,044.87                   | 116,646.46        | 7.496                    | 36.68            | .085                | .44              | 15,569.5              | 3,180        | 118,045.88          | 7.58                          | 37.12            |                                                                                    |
| New Orleans Harbor.. | 23,704.95                            | 9,526.07                    | 15,588.90                   | 16,266.67         | 9.037                    | 27.11            | .764                | 2.29             | 1,800                 | 600          | 17,642.12           | 9.80                          | 29.40            |                                                                                    |

<sup>1</sup> Includes every item of field and overhead charges.<sup>2</sup> Squares include both subaqueous and upper bank work.<sup>3</sup> Value of material used belonging to general repairs and stone.

*Condition at end of present year.*—A total of 55,125 linear feet of bank has been protected by continuous mattress revetment, by submerged sloping spur dikes in conjunction with continuous mattress, and by spur dikes alone. Where thus protected, the banks have been made reasonably permanent, and the destruction of wharves, railroad inclines, and other commercial facilities has been prevented. About 75 per cent of the project has been completed. There remains about 5,000 linear feet of bank to be revetted, and the intervals between the spur dikes in the Gouldsboro Bend require to be covered with continuous mattress.

Total expenditures on existing project were \$1,869,458.86 for new work and \$254,359.07 for maintenance, making a total of \$2,123,817.93. The project has not yet been completed.

*Local cooperation.*—The city of New Orleans undertook to protect the bank in the Third District Reach and expended \$327,417.04 for this purpose. The State of Louisiana, through the board of commissioners of the port of New Orleans, has expended \$10,000,000 for the construction of wharves and other terminal facilities. The funds expended were obtained by the sale of bonds and by local taxation.

*Proposed operations.*—It is proposed to close the gap in the Greenville Bend revetment with continuous mattress work, to mattress the bank in the intervals between the spurs in the Gouldsboro Bend, and to maintain existing revetments.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river, and the commercial terminal facilities of the harbor have been rendered reasonably permanent.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |                              |
|--------------------------------------------|------------------------------|
| New work.....                              | \$1, 984, 023. 58            |
| Maintenance.....                           | 224, 451. 07                 |
| Total .....                                | <sup>1</sup> 2, 208, 474. 65 |
| Total appropriations to June 30, 1917..... | 2, 346, 450. 86              |

| Fiscal year ending June 30.   | 1913          | 1914          | 1915          | 1916          | 1917                     |
|-------------------------------|---------------|---------------|---------------|---------------|--------------------------|
| Expended for new work.....    | \$15, 500. 00 | \$42, 525. 01 | \$59, 060. 74 | \$42, 813. 92 | .....                    |
| Expended for maintenance..... | 1, 722. 21    | 2, 000. 00    | 2, 827. 93    | 12, 585. 85   | <sup>1</sup> 22, 420. 85 |
| Total expended.....           | 17, 222. 21   | 44, 525. 01   | 61, 888. 67   | 55, 399. 77   | 22, 420. 85              |
| Appropriated or allotted..... | 70, 000. 00   | 50, 000. 00   | 45, 000. 00   | 130, 000. 00  | .....                    |

|                                                                                                           |                          |
|-----------------------------------------------------------------------------------------------------------|--------------------------|
| July 1, 1916, balance unexpended.....                                                                     | \$24, 688. 42            |
| Amount allotted from river and harbor act approved July 27, 1916.....                                     | 130, 000. 00             |
|                                                                                                           | 154, 688. 42             |
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... | <sup>1</sup> 22, 420. 85 |
| July 1, 1917, balance unexpended.....                                                                     | 132, 267. 57             |
| July 1, 1917, outstanding liabilities.....                                                                | 8, 724. 74               |
| July 1, 1917, balance available for fiscal year ending June 30, 1918.....                                 | 123, 542. 83             |

<sup>1</sup> \$5,708.64 received for wear and tear of plant and sales of blue prints not included.

*Abstract of appropriations.*

| Act of Congress.                                         | Allotted.     | Amount.              |
|----------------------------------------------------------|---------------|----------------------|
| <b>"IMPROVING HARBOR AT NEW ORLEANS, LA."</b>            |               |                      |
| June 18, 1878 (river and harbor).....                    |               | \$50,000             |
| Mar. 3, 1879 (sundry civil).....                         |               | 60,000               |
| June 16, 1880 (sundry civil).....                        |               | 75,000               |
| Mar. 3, 1881 (river and harbor).....                     |               | 75,000               |
| Aug. 2, 1882 (river and harbor).....                     | (1)           | 162                  |
| Jan. 19, 1884 (river and harbor).....                    | (1)           | 1,400                |
| July 5, 1884 (river and harbor).....                     | (1)           | 4,900                |
| July 13, 1892 (river and harbor).....                    |               | 80,000               |
| Aug. 18, 1894 (sundry civil).....                        |               | 110,000              |
| June 3, 1896 (river and harbor).....                     | June 27, 1896 | 110,000              |
| Mar. 3, 1899 (sundry civil).....                         | Mar. 13, 1899 | 110,000              |
|                                                          |               | 676,462              |
| <b>"IMPROVING MISSISSIPPI RIVER—NEW ORLEANS HARBOR."</b> |               |                      |
| Aug. 5, 1886 (river and harbor).....                     |               | 75,000               |
| Aug. 11, 1888 (river and harbor).....                    |               | <sup>2</sup> 199,888 |
| Sept. 19, 1890 (river and harbor).....                   | Oct. 15, 1890 | 90,000               |
| Do.....                                                  | Dec. 4, 1890  | 10,000               |
| Do.....                                                  | (1)           | 8,000                |
| June 4, 1897 (river and harbor).....                     | (1)           | 10,000               |
| Do.....                                                  | (1)           | 40,000               |
| June 13, 1902 (river and harbor).....                    | July 12, 1902 | 95,000               |
| Mar. 3, 1905 (sundry civil).....                         | Apr. 26, 1905 | 85,000               |
| June 30, 1906 (sundry civil).....                        | June 28, 1906 | 10,000               |
| Mar. 2, 1907 (river and harbor).....                     | July 12, 1907 | 100,000              |
| May 27, 1908 (sundry civil).....                         | May 4, 1908   | 150,000              |
| Mar. 4, 1909 (sundry civil).....                         | Apr. 28, 1909 | 100,000              |
| June 25, 1910 (river and harbor).....                    | July 25, 1910 | 175,000              |
| Feb. 27, 1911 (river and harbor).....                    | May 3, 1911   | <sup>3</sup> 192,000 |
| July 25, 1912 (river and harbor).....                    | Aug. 3, 1912  | 35,000               |
| Mar. 4, 1913 (river and harbor).....                     | Apr. 30, 1913 | <sup>4</sup> 70,000  |
| Oct. 2, 1914 (river and harbor).....                     | Oct. 15, 1914 | 50,000               |
| Mar. 4, 1915 (river and harbor).....                     | Apr. 18, 1915 | <sup>5</sup> 45,000  |
| July 27, 1916 (river and harbor).....                    | Aug. 14, 1916 | 130,000              |
|                                                          |               | 1,669,988            |
| Grand total.....                                         |               | 2,346,450            |

<sup>1</sup> By transfer.<sup>2</sup> Original appropriation, \$200,000; \$112 reserved by the Chief of Engineers for office expenses.<sup>3</sup> Original allotment, \$200,000; \$8,000 transferred to plant, fourth district.<sup>4</sup> Original allotment, \$80,000; \$10,000 transferred to Atchafalaya and Red Rivers, La.<sup>5</sup> Original allotment, \$50,000; \$5,000 transferred to surveys.*Contracts in force.—None.**(i) General repairs and stone.*

The general character of operations under this allotment renders it impracticable to give data as to location, original condition, previous and present projects, etc.

The allotment is intended to cover unforeseen contingencies on the sewer works throughout the district and the purchase of stone. Amount spent prior to the beginning of the present year was \$70,194.71. The work comes under the general project for improving the Mississippi River. An allotment of \$23,000 was made during the present year, and there was a balance of \$19,805.29 on hand from previous allotments.

During the period covered by this report, \$23,865.14 was expended for the purchase of stone for New Orleans Harbor, for Plaquemine, La., for concrete ballast, and for administration.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |            |
|--------------------------------------------|------------|
| New work.....                              | \$39,318.2 |
| Maintenance.....                           | 55,294.4   |
| Total expended.....                        | 94,612.7   |
| Total appropriations to June 30, 1917..... | 113,000.0  |

| Fiscal year ending June 30.   | 1913       | 1914        | 1915        | 1916        | 1917        |
|-------------------------------|------------|-------------|-------------|-------------|-------------|
| Expended for new work.....    |            | \$12,099.56 | \$15,175.65 | \$12,043.06 |             |
| Expended for maintenance..... | \$2,724.02 | 4,941.96    | 1,028.13    |             | \$24,418.05 |
| Total expended.....           | 2,724.02   | 17,041.52   | 16,203.78   | 12,043.06   | 24,418.05   |
| Appropriated or allotted..... |            | 20,000.00   | 25,000.00   | 23,000.00   |             |

July 1, 1916, balance unexpended..... \$19,805.29  
Amount allotted from river and harbor act approved July 27, 1916... 23,000.00

42,805.29

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... 24,418.05

July 1, 1917, balance unexpended..... 18,387.24  
July 1, 1917, outstanding liabilities..... 730.62

July 1, 1917, balance available for fiscal year ending June 30, 1918... 17,656.62

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.     | Amount.     |
|---------------------------------------|---------------|-------------|
| Feb. 27, 1911 (river and harbor)..... | May, 3, 1911  | \$25,000.00 |
| July 25, 1912 (river and harbor)..... | Aug. 3, 1912  | 20,000.00   |
| Oct. 2, 1914 (river and harbor).....  | Oct. 15, 1914 | 20,000.00   |
| Mar. 4, 1915 (river and harbor).....  | Apr. 18, 1915 | 25,000.00   |
| July 27, 1916 (river and harbor)..... | Aug. 14, 1916 | 23,000.00   |
| Total.....                            |               | 113,000.00  |

*Contracts in force.*—None.

II. LEVEES.

(a) *Lower Tensas levee district.*

*Location.*—The Lower Tensas levee district extends on the right bank, in continuation of the Upper Tensas levee district, from a point opposite Warrenson, Miss., 607 miles below Cairo, to the mouth of Red River, 764 miles below Cairo, with a river frontage of 157 miles and an area of 2,080 square miles. The levee line is continuous from the upper end of the district down to Point Breeze, 755 miles below Cairo. The total length of levee line is 157.29 miles, of which 150.34 miles have been built.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Present project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results prior to the present year.*—Under the present project work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. As work has progressed on the project a constantly increasing amount of protection has been afforded by the levees. Previous to 1882 gaps existed in the

levee line at Diamond Island, Bougere, and Black Hawk to Red River. The Diamond Island gaps were closed in 1889. The Bougere gap was closed by a levee 2½ miles long, connecting with the Texas & Pacific Railway embankment which served as a levee for a distance of 4.8 miles to Union Point. This gap was closed in 1902. The levee line was extended from Black Hawk to Point Breeze in 1905. During the flood of 1903 the Texas & Pacific Railway embankment and the levees built by local authorities were destroyed. In 1910 the Bougere Levee from Ashland to Union Point was completed. Crevasses in the levee line have occurred as follows:

|                                 |    |
|---------------------------------|----|
| 1882 (numerous small) important | 49 |
| 1884                            | 59 |
| 1890                            | 3  |
| 1897                            | 1  |
| 1903                            | 1  |
| 1913                            | 1  |
| 1916                            | 1  |

Except as above noted, the uncompleted system has protected the basin from floods. The amounts spent for new work and for maintenance prior to the beginning of the present fiscal year are \$4,492,214.23 and \$488,832.52, respectively, a total of \$4,981,046.75.

*Operations and results during present year.*—Construction has been continued by contract and by hired labor. The work under construction and the progress thereon is shown in the following table and has resulted in increased protection against floods:

| Name of levee.        | Kind of work.        | Miles below Cairo. | Length.      | Average height. | In contract.        |
|-----------------------|----------------------|--------------------|--------------|-----------------|---------------------|
|                       |                      |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Dunn                  | Enlargement..        | 611.5 R.           | 3,700        | 21.6            | 101,989.56          |
| Hodge                 | do                   | 613.5 R.           | 4,493        | 22.1            | 89,952.14           |
| Hunter                | do                   | 614 R.             | 3,600        | 24.6            | 87,034.29           |
| Diamond Island        | do                   | 614.5 R.           | 3,300        | 24.9            | 91,426.46           |
| Shelulah              | do                   | 615 R.             | 4,300        | 25.1            | 106,676.81          |
| Bayou Roundaway       | do                   | 616 R.             | 7,900        | 16.1            | 89,864.57           |
| Dahlia                | do                   | 619 R.             | 5,900        | 22.1            | 101,265.43          |
| Davis Island          | New and enlargement. | 624 R.             | 730          | 17.4            | 20,044.97           |
| Point Pleasant        | Enlargement..        | 624 R.             | 1,400        | 22.0            | 33,630.03           |
| Buck Ridge            | New                  | 630 R.             | 3,908        | 17.0            | 277,662.70          |
| White Oak Lake        | Enlargement..        | 630-32 R.          | 17,186       | 24.0            | 51,051.07           |
| White Oak Lake, lot 1 | do                   | 630 R.             | 4,913        | 22.1            | 138,948.72          |
| Hard Times, lot 1     | do                   | 632 R.             | 3,533        | 24.0            | 98,713.96           |
| Kempe                 | New and enlargement  | 656 R.             | 4,328        | 23.0            | 150,000.00          |
| Kempe, lot 2          | Enlargement..        | 658 R.             | 5,871        | 21.0            | 124,833.22          |
| L'Argent              | New                  | 668 R.             | 5,650        | 7.0             | 40,285.24           |
| Total                 |                      |                    |              |                 | 1,603,379.17        |

| Name of levee.        | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.      | Required to complete. |
|-----------------------|---------------------|-----------------------|-----------------------|------------|-----------------------|
|                       | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |            | <i>Cubic yards.</i>   |
| Dunn                  | 46,981.27           | 50,809.49             | 14.98                 | \$7,611.26 | 50,008.29             |
| Hodge                 | 3,277.56            | 3,277.56              | 23.40                 | 766.95     | 86,674.58             |
| Hunter                | 16,513.17           | 7,969.68              | 20.90                 | 1,665.66   | 70,521.12             |
| Diamond Island        |                     |                       | 24.70                 |            | 91,426.46             |
| Shelulah              |                     |                       | 25.70                 |            | 106,676.81            |
| Bayou Roundaway       | 42,937.80           | 29,506.68             | 16.40                 | 4,839.09   | 26,620.77             |
| Dahlia                | 15,784.43           | 21,315.46             | 17.47                 | 3,723.81   |                       |
| Davis Island          | 20,044.97           | 20,044.97             | 32.00                 | 6,414.40   |                       |
| Point Pleasant        | 33,630.03           | 33,630.03             | 11.71                 | 3,939.31   |                       |
| Buck Ridge            | 122,242.70          | 122,242.70            | 26.04                 | 3,182.00   |                       |
| White Oak Lake        | 33,251.25           | 33,214.25             | 42.90                 | 14,248.91  | 17,799.82             |
| White Oak Lake, lot 1 | 17,931.72           | 20,043.33             | 16.70                 | 3,347.24   |                       |
| Hard Times, lot 1     | 37,475.02           | 38,226.26             | 17.37                 | 6,639.90   |                       |
| Kempe                 |                     |                       | 31.50                 |            | 150,000.00            |
| Kempe, lot 2          | 98,721.27           | 103,858.39            | 21.00                 | 21,810.27  |                       |
| L'Argent              | 40,285.24           | 40,285.24             | 16.00                 | 6,445.64   |                       |
| Total                 | 529,076.43          | 524,424.04            |                       | 113,284.44 | 599,727.85            |

<sup>1</sup> Field cost by hired labor.

|                     | Location.       |             |                           | Location.       |             |
|---------------------|-----------------|-------------|---------------------------|-----------------|-------------|
|                     | Point Pleasant. | Buck Ridge. |                           | Point Pleasant. | Buck Ridge. |
| Machine—Beauregard: |                 |             | Machine—Beauregard—Contd. |                 |             |
| Mobilization.....   | \$1,666.38      | \$4,649.66  | Surveys.....              | \$29.92         | \$70.00     |
| Clearing.....       |                 | 144.50      | Depreciation.....         | 1,166.67        | 4,666.67    |
| Drainage.....       | 132.60          | 244.48      | Overhead.....             | 127.12          | 381.55      |
| Plowing.....        | 207.50          | 1,041.21    |                           |                 |             |
| Operation.....      | 1,221.12        | 21,839.27   | Total cost.....           | 5,233.10        | 36,880.22   |
| Repairs.....        | 423.19          | 3,284.10    |                           |                 |             |
| Dressing.....       | 180.60          | 502.56      | Handled.....yards..       | 33,630.03       | 122,242.70  |
| Sodding.....        | 78.60           | 56.22       | Cost per yard.....cents.. | 15.50           | 30.17       |

On April 26, 1917, the Vicksburg gauge reached 49.9 feet, a stage which rendered it necessary to adopt precautionary measures for high-water protection. Patrols were placed on the levee line and barges, loaded with material, were placed at intervals along the levee.

The cost of high-water protection was \$2,276.48.

Work was done by contract and by hired labor. Work on the various levees was commenced and finished as follows:

| Name of levee.             | Miles below Cairo. | Work commenced. | Work finished. | Remarks.             |
|----------------------------|--------------------|-----------------|----------------|----------------------|
| Dunn.....                  | 611.5 R.           | May 24, 1916    | .....          | Under construction.  |
| Hodge.....                 | 613.5 R.           | June 10, 1916   | .....          | Do.                  |
| Hunter.....                | 614 R.             | Aug. 14, 1916   | .....          | Do.                  |
| Diamond Island.....        | 614.5 R.           | .....           | .....          | Work not begun.      |
| Shelulah.....              | 615 R.             | .....           | .....          | Do.                  |
| Bayou Roundaway.....       | 616 R.             | Oct. 28, 1915   | .....          | Under construction.  |
| Dahli.....                 | 619 R.             | Feb. 26, 1915   | Sept. 20, 1916 |                      |
| Davis' Island.....         | 624 R.             | Nov. 2, 1916    | Jan. 15, 1917  |                      |
| Joint Pleasant.....        | 624 R.             | Sept. 26, 1916  | Oct. 14, 1916  | Done by hired labor. |
| Buck Ridge.....            | 630 R.             | Apr. 6, 1916    | Sept. 16, 1916 | Do.                  |
| White Oak Lake.....        | 630 R.             | Nov. 16, 1916   | .....          | Under construction.  |
| White Oak Lake, lot 1..... | 630-32 R.          | Nov. 21, 1914   | Nov. 15, 1916  |                      |
| Hard Times, lot 1.....     | 632 R.             | Aug. 1, 1915    | Aug. 31, 1916  |                      |
| Kempe.....                 | 656 R.             | .....           | .....          | Work not begun.      |
| Kempe, lot 2.....          | 658 R.             | Jan. 1, 1916    | Nov. 3, 1916   |                      |
| L'Argent (sublevee).....   | 660 R.             | Nov. 21, 1916   | Apr. 14, 1917  |                      |

The total work done by the United States and local authorities is as follows:

|                                       | Cubic yards. |
|---------------------------------------|--------------|
| Constructed by the United States..... | 529, 076     |
| Constructed by local authorities..... | 1, 104, 699  |

|                                                   |             |
|---------------------------------------------------|-------------|
| Total constructed during the year.....            | 1, 633, 775 |
| Percentage of work done by the United States..... | 32. 4       |

The result has been to give added protection against floods. The completed levee line is 14.55 miles in length.

Condition at end of present year.—The following is the condition of the levee at the end of the present year (May 31, 1917):

|                                                                                                                                        |                         |              |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------|
| Project for earthwork.....                                                                                                             | per cent completed..... | 67. 8        |
| Miles in system.....                                                                                                                   | .....                   | 157. 29      |
| Miles built.....                                                                                                                       | .....                   | 150. 34      |
| Yardage lost during year.....                                                                                                          | .....                   | 775, 957     |
| Contents of levee (May 31, 1917).....                                                                                                  | cubic yards.....        | 30, 951, 973 |
| Required to bring levees to grade and section.....                                                                                     | do.....                 | 14, 673, 000 |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years..... | cubic yards.....        | 15, 590, 000 |

<sup>1</sup> Does not include 26,000 cubic yards in a drainage ditch.

<sup>2</sup> Does not include 928,721 cubic yards under contract, of which 683,003 cubic yards are new work.

## Miles of levee above highest water:

|                                                                |        |
|----------------------------------------------------------------|--------|
| Less than 1 foot.....                                          | 6. 82  |
| From 1 to 2 feet.....                                          | 20. 34 |
| From 2 to 3 feet.....                                          | 56. 87 |
| From 3 to 4 feet.....                                          | 26. 36 |
| From 4 to 5 feet.....                                          | 16. 32 |
| Miles of levee up to full grade, but deficient in section..... | 9. 11  |
| Miles of levee up to full grade and section.....               | 14. 57 |

*Local cooperation.*—Local authorities have expended, in part and between 1882 and January 1, 1917, \$3,557,678.12 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered.

*Proposed operations.*—The project is 32.2 per cent uncompleted. The work proposed for the next year consists of completing work under contract and in extending the completed line, nearly as practicable, continuously downstream. The object of this work is to secure the levee line at its head.

*Effect of improvement.*—The effect of the improvement is to give an increasingly reliable protection against floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded, and any delay may cause serious damage.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |                   |
|--------------------------------------------|-------------------|
| New work.....                              | \$4, 756, 799. 70 |
| Maintenance.....                           | 408, 635. 60      |
| Total expended.....                        | 5, 165, 435. 30   |
| Total appropriations to June 30, 1917..... | 5, 583, 950. 50   |

| Fiscal year ending June 30.   | 1913           | 1914           | 1915           | 1916           | 1917           |
|-------------------------------|----------------|----------------|----------------|----------------|----------------|
| Expended for new work.....    | \$103, 467. 08 | \$579, 918. 88 | \$162, 846. 41 | \$150, 505. 89 | \$134, 487. 52 |
| Expended for maintenance..... | 26, 579. 08    | 58, 823. 97    | .....          | 30, 316. 34    | 2, 343. 63     |
| Total expended.....           | 130, 046. 16   | 638, 742. 85   | 162, 846. 41   | 180, 822. 23   | 136, 831. 15   |
| Appropriated or allotted..... | 415, 500. 00   | 275, 000. 00   | 248, 000. 00   | 324, 000. 00   | .....          |

July 1, 1916, balance unexpended..... \$231, 346. 35

Amount allotted from river and harbor act, approved July 27, 1916..... 324, 000. 00

555, 346. 35

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales:

|                      |                |
|----------------------|----------------|
| For new work.....    | \$134, 487. 52 |
| For maintenance..... | 2, 343. 63     |
|                      | 136, 831. 15   |

July 1, 1917, balance unexpended..... 418, 515. 20

July 1, 1917, outstanding liabilities..... \$70, 369. 24

July 1, 1917, amount covered by uncompleted contracts..... 174, 997. 50

245, 366. 74

July 1, 1917, balance available for fiscal year ending June 30, 1918..... 173, 148. 46

*Abstract of appropriations.*

| Act of Congress.                                | Allotted.     | Amount.                 |
|-------------------------------------------------|---------------|-------------------------|
| <b>"LEVEES, TENSAS FRONT."</b>                  |               |                         |
| Aug. 2, 1882 (river and harbor).....            |               | \$426,160.00            |
| Jan. 19, 1884 (river and harbor).....           |               | 21,000.00               |
| Do.....                                         | (1)           | 3,000.00                |
| July 5, 1884 (river and harbor).....            |               | 90,000.00               |
| Do.....                                         |               | 8,710.00                |
| Do.....                                         | (1)           | 3,400.00                |
| Do.....                                         | June 16, 1886 | 1,000.00                |
| Aug. 6, 1886 (river and harbor).....            | Nov. 20, 1886 | 11,100.00               |
| Do.....                                         | July 7, 1887  | 15,000.00               |
| Aug. 5, 1886 (river and harbor).....            | Aug. —, 1887  | 150,000.00              |
| Aug. 11, 1888 (river and harbor).....           | Oct. 3, 1888  | <sup>2</sup> 160,000.00 |
|                                                 |               | 889,370.00              |
| <b>"PROTECTION OF LEVEES, TENSAS FRONT."</b>    |               |                         |
| Aug. 5, 1886 (river and harbor).....            | Mar. 4, 1887  | 7,000.00                |
| Do.....                                         | Aug. —, 1887  | 6,000.00                |
| Aug. 11, 1888 (river and harbor).....           | Oct. 3, 1888  | 10,000.00               |
|                                                 |               | 23,000.00               |
| <b>"LEVEES TENSAS BASIN."</b>                   |               |                         |
| Sept. 19, 1890 (river and harbor).....          | Dec. 4, 1890  | 199,500.00              |
| Do.....                                         | (1)           | 38,475.00               |
| Do.....                                         |               | 11,542.50               |
| Do.....                                         | (1)           | 1,334.75                |
| Do.....                                         | (1)           | 3,000.00                |
| Aug. 5, 1886 (river and harbor).....            | (3)           | 21.00                   |
|                                                 |               | 253,873.25              |
| <b>"PROTECTION OF LEVEES, TENSAS BASIN."</b>    |               |                         |
| Sept. 19, 1890 (river and harbor).....          |               | 9,525.00                |
| Do.....                                         | (1)           | 607.50                  |
| Do.....                                         | (1)           | 70.25                   |
| Do.....                                         | (1)           | 5,000.00                |
| Do.....                                         | (1)           | 5,000.00                |
|                                                 |               | 20,202.75               |
| <b>"PROTECTION OF LEVEES, FOURTH DISTRICT."</b> |               |                         |
| Aug. 11, 1888 (river and harbor).....           |               | 29,211.94               |
| <b>"LOWER TENSAS LEVEE DISTRICT."</b>           |               |                         |
| July 13, 1892 (river and harbor).....           | Aug. 10, 1892 | 150,000.00              |
| Mar. 3, 1893 (sundry civil).....                | May 18, 1893  | 132,000.00              |
| Aug. 18, 1894 (sundry civil).....               |               | <sup>4</sup> 67,000.00  |
| Mar. 2, 1895 (sundry civil).....                |               | <sup>5</sup> 89,360.00  |
| June 3, 1896 (river and harbor).....            | June —, 1896  | 45,000.00               |
| June 4, 1897 (sundry civil).....                | Aug. 20, 1897 | 228,700.00              |
| July 19, 1897 (deficiency).....                 | July 19, 1897 | 45,000.00               |
| July 1, 1898 (sundry civil).....                | Mar. 10, 1898 | 120,000.00              |
| Do.....                                         | June 29, 1898 | 30,000.00               |
| Do.....                                         | Jan. 17, 1899 | 3,000.00                |
| Do.....                                         | Jan. 24, 1899 | 5,000.00                |
| Mar. 3, 1899 (sundry civil).....                | Mar. 13, 1899 | 217,300.00              |
| June 6, 1900 (sundry civil).....                | July 20, 1900 | 110,000.00              |
| June 13, 1902 (river and harbor).....           | July 12, 1902 | 110,000.00              |
| Mar. 3, 1903 (sundry civil).....                | Nov. 25, 1903 | 110,000.00              |
| Apr. 28, 1904 (sundry civil).....               | June 25, 1903 | 110,000.00              |
| Mar. 3, 1905 (sundry civil).....                | Apr. 26, 1905 | 110,000.00              |
| Mar. 3, 1905 (river and harbor).....            | July 29, 1905 | 85,000.00               |
| Do.....                                         | (1)           | 18,932.86               |
| June 30, 1906 (sundry civil).....               | June 28, 1906 | 235,000.00              |
| Mar. 2, 1907 (river and harbor).....            | Mar. 27, 1907 | 300,000.00              |
| May 2, 1908 (sundry civil).....                 | May 4, 1908   | 100,000.00              |

<sup>1</sup> By transfer.<sup>2</sup> Original allotment, \$175,000; \$5,000 transferred to protection of third district; \$10,000 to protection, fourth district.<sup>3</sup> Original allotment, \$197,000; \$19,000 transferred to harbors at Natchez, Miss., and Vidalia, La. By transfer \$70,000.<sup>4</sup> Original allotment, \$132,000; \$65,000 transferred to Middle Tensas district.<sup>5</sup> Original allotment, \$132,000; \$40,000 transferred to Middle Tensas district, and \$2,640 to Homochitto district.

*Abstract of appropriations—Continued.*

| Act of Congress.                                | Allotted.     | Amount.                 |
|-------------------------------------------------|---------------|-------------------------|
| <b>"LOWER TENSAS LEVEE DISTRICT"—continued.</b> |               |                         |
| Mar. 4, 1909 (sundry civil).....                | Apr. 28, 1909 | \$100,000.00            |
| June 25, 1910 (sundry civil).....               | Apr. 30, 1910 | 160,000.00              |
| June 25, 1910 (river and harbor).....           | July 6, 1910  | 50,000.00               |
| Feb. 27, 1911 (river and harbor).....           | July 8, 1911  | 50,000.00               |
| June 25, 1910 (river and harbor).....           | (1)           | 12,000.00               |
| July 25, 1912 (river and harbor).....           | Aug. 3, 1912  | <sup>2</sup> 312,500.00 |
| Mar. 4, 1913 (river and harbor).....            | Apr. 30, 1913 | 400,000.00              |
| Do.....                                         | (1)           | 15,000.00               |
| Mar. 4, 1913 (river and harbor).....            | (1)           | 500.00                  |
| Oct. 2, 1914 (river and harbor).....            | Oct. 15, 1914 | 275,000.00              |
| Mar. 4, 1915 (river and harbor).....            | Apr. 18, 1915 | <sup>3</sup> 248,000.00 |
| July 27, 1916 (river and harbor).....           | Aug. 14, 1916 | <sup>4</sup> 324,000.00 |
|                                                 |               | 4,368,292.86            |
| Grand total.....                                |               | 5,583,950.50            |

<sup>1</sup> By transfer.<sup>2</sup> Original allotment, \$320,000; \$7,500 transferred to Upper Tensas district.<sup>3</sup> Original allotment, \$197,000; \$19,000 transferred to harbors at Natchez, Miss., and Vidalia, La. By transfer \$70,000.<sup>4</sup> Original allotment, \$350,000; \$26,000 transferred to Memphis Harbor.*Contracts in force.*

| Name of contractor.          | Amount of work. | Character of work.    | Unit price.   | Date of approval. |
|------------------------------|-----------------|-----------------------|---------------|-------------------|
|                              |                 |                       | <i>Cents.</i> | 1915.             |
| E. H. Jackson.....           | 102,024.89      | Enlargement.....      | 14.98         | Nov. 13           |
| W. C. Mullen.....            | 89,952.14       | do.....               | 23.40         | Do.               |
| L. E. Pickett.....           | 87,034.29       | do.....               | 20.90         | Do.               |
| W. C. Mullen.....            | 91,426.46       | do.....               | 24.70         | Do.               |
| Do.....                      | 106,676.81      | do.....               | 25.70         | Do.               |
| N. C. Williamson.....        | 89,864.57       | do.....               | 16.40         | Do.               |
|                              |                 |                       |               | 1916.             |
| Jackson Construction Co..... | 51,051.07       | do.....               | 42.90         | Nov. 20           |
| Francis T. Constant.....     | 150,000.00      | New and enlarged..... | 31.50         | Do.               |

| Name of contractor.          | Date of beginning. | Date of expiration. | Percentage completed. | Levee.               | Miles below Cairo. |
|------------------------------|--------------------|---------------------|-----------------------|----------------------|--------------------|
|                              | 1915.              | 1916.               |                       |                      |                    |
| E. H. Jackson.....           | Oct. 13            | Dec. 15             | 53.8                  | Dunn.....            | 611.5 R.           |
| W. C. Mullen.....            | Oct. 28            | do.                 | 3.6                   | Hodge.....           | 613.5 R.           |
| L. E. Pickett.....           | do.                | do.                 | 19.0                  | Hunter.....          | 614 R.             |
| W. C. Mullen.....            | Oct. 12            | do.                 |                       | Diamond Island.....  | 614.5 R.           |
| Do.....                      | do.                | do.                 |                       | Shelulah.....        | 615 R.             |
| N. C. Williamson.....        | Oct. 13            | do.                 | 70.4                  | Bayou Roundaway..... | 616 R.             |
|                              | 1916.              | 1917.               |                       |                      |                    |
| Jackson Construction Co..... | Nov. 20            | Jan. 31             | 65.1                  | White Oak Lake.....  | 630-32 R.          |
|                              |                    | 1918.               |                       |                      |                    |
| Francis T. Constant.....     | Nov. 15            | Jan. 5              |                       | Kempe.....           | 656 R.             |

*(b) Atchafalaya levee district.*

*Location.*—The Atchafalaya levee district extends on the right bank of the Mississippi River from Red River, 764 miles below Cairo, to Bayou Lafourche, 886 miles below Cairo, with a river frontage of 122 miles and an area of 6,035 square miles. The levee line is continuous and is 127.87 miles in length, all of which has been built.

*Original condition.*—Originally, there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Present project.*—The present project is to build and enlarge the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargements of the existing levee line in cooperation with the State and local levee boards to a grade of 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results prior to the present year.*—Under the present project, work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. This work has progressed on the project, a constantly increasing amount of protection has been afforded by the levees.

In 1882 all gaps in the levee line had been closed. The following crevasses have occurred:

|                                |    |
|--------------------------------|----|
| 882 (numerous small) important | 7  |
| 884                            | 8  |
| 890                            | 13 |
| 892                            | 1  |
| 912                            | 1  |

Although uncompleted, the levee system has afforded complete protection for 5 out of the preceding 27 years. The amounts spent for new work and maintenance prior to the beginning of the present fiscal year are \$1,981,783.20 and \$160,424.69, respectively, a total of \$2,142,207.89.

*Operations and results during the present year.*—Construction has been continued by contract. The work under construction is shown in the following table and has resulted in increased protection against floods:

| Name of levee.   | Kind of work.       | Miles below Cairo. | Length.      | Average height. | In contract.      |
|------------------|---------------------|--------------------|--------------|-----------------|-------------------|
|                  |                     |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cu. yards.</i> |
| ed River landing | Enlargement         | 765 R.             | 7,004        | 20.9            | 197,871.90        |
| nithland         | New                 | 766.5 R.           | 5,095        | 16.5            | 240,767.19        |
| enrietta         | New and enlargement | 767.8 R.           | 9,829        | 13.9            | 255,574.93        |
| atenache         | Enlargement         | 768.5 R.           | 7,140        | 16.2            | 103,853.67        |
| elle Vista       | do.                 | 769.5 R.           | 9,400        | 16.5            | 103,184.97        |
| atchelor         | do.                 | 772 R.             | 5,800        | 19.0            | 104,168.70        |
| ormandy          | do.                 | 773.5 R.           | 5,700        | 19.9            | 104,410.18        |
| nique            | do.                 | 775 R.             | 5,500        | 18.0            | 101,616.02        |
| ongwood          | do.                 | 775.5 R.           | 3,003        | 26.6            | 118,131.51        |
| pper Cocoa       | New and enlargement | 777 R.             | 3,136        | 25.9            | 102,862.02        |
| ower Cocoa       | Enlargement         | 777.5 R.           | 3,200        | 22.3            | 105,759.09        |
| acour, lot 1     | New and enlargement | 778 R.             |              | 25.0            | 181,972.77        |
| acour, lot 2     | Enlargement         | 780 R.             | 2,400        | 24.5            | 104,841.73        |
| Total            |                     |                    |              |                 | 1,825,014.68      |

| Name of levee.   | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.      | Required to complete. |
|------------------|---------------------|-----------------------|-----------------------|------------|-----------------------|
|                  | <i>Cu. yards.</i>   | <i>Cu. yards.</i>     | <i>Cents.</i>         |            | <i>Cu. yards.</i>     |
| ed River landing |                     |                       | 13.47                 |            | 197,871.90            |
| nithland         |                     |                       | 13.47                 |            | 240,767.19            |
| enrietta         | 29,976.32           |                       | 13.47                 |            | 225,598.61            |
| atenache         | 103,853.67          | 103,853.67            | 9.23                  | \$9,585.69 |                       |
| elle Vista       | 103,184.97          | 103,184.97            | 9.23                  | 9,523.98   |                       |
| atchelor         | 46,946.67           | 43,302.33             | 9.23                  | 3,996.80   | 57,222.03             |
| ormandy          | 9,696.81            | 6,651.54              | 9.23                  | 613.94     | 94,713.37             |
| nique            |                     |                       | 9.23                  |            | 101,616.02            |
| ongwood          | 31,073.58           | 33,030.88             | 24.87                 | 8,214.77   |                       |
| pper Cocoa       | 33,254.01           | 29,126.82             | 16.00                 | 4,660.29   |                       |
| ower Cocoa       | 38,134.52           | 70,013.68             | 16.00                 | 11,202.19  |                       |
| acour, lot 1     | 113,846.13          | 125,624.47            | 16.00                 | 20,099.92  |                       |
| acour, lot 2     |                     |                       | 11.89                 |            | 11,444.73             |
| Total            | 509,966.68          | 514,788.36            |                       | 67,897.58  | 929,233.85            |

56,063.95 cubic yards at a cost of \$9,469.55 were pumped in over the sand boils area at Grand Bay (808 R.).

All work was done by contract. Work on the various levees was commenced and finished as follows:

| Name of levee.          | Miles below Cairo. | Work commenced. | Work finished. | Remarks.            |
|-------------------------|--------------------|-----------------|----------------|---------------------|
| Red River Landing ..... | 765 R.             |                 |                | Work not begun.     |
| Smithland .....         | 766.5 R.           |                 |                | Do.                 |
| Henrietta .....         | 767.8 R.           | May 14, 1917    |                | Under construction. |
| Latenache .....         | 768.5 R.           | May 29, 1916    | Oct. 6, 1916   |                     |
| Belle Vista .....       | 769.5 R.           | Sept. 15, 1916  | Jan. 2, 1917   |                     |
| Batchelor .....         | 772 R.             | Dec. 20, 1916   |                | Do.                 |
| Normandy .....          | 773.5 R.           | Mar. 5, 1917    |                | Do.                 |
| Unique .....            | 775 R.             |                 |                | Work not begun.     |
| Longwood .....          | 775.5 R.           | Sept. 18, 1914  | Nov. 4, 1916   |                     |
| Upper Cocca .....       | 777 R.             | Dec. 5, 1914    | Sept. 3, 1916  |                     |
| Lower Cocca .....       | 777.5 R.           | Dec. 28, 1914   | Sept. 9, 1916  |                     |
| Lacour:                 |                    |                 |                |                     |
| Lot 1 .....             | 778 R.             | Dec. 15, 1914   | Mar. 22, 1917  |                     |
| Lot 2 .....             | 780 R.             | May 18, 1915    |                | Under construction. |

The total work done by the United States and local authorities is as follows:

Constructed by the United States ..... cubic yards..... 509,967  
 Constructed by local authorities ..... do ..... <sup>1</sup>182,934

Total constructed during the year ..... do ..... 692,901  
 Percentage of work done by the United States ..... 73.6

The result has been to give added protection against floods. Seven and twenty-six one-hundredths miles of levee have been completed to grade and section.

*Condition at end of present year.*—The following is the condition of the levees at the end of the present year (May 31, 1917):

Project for earthwork ..... per cent completed..... 64.5  
 Miles in system ..... 127.87  
 Miles built ..... 127.87  
 Yardage lost during the year ..... 214,800  
 Contents of levees (May 31, 1917) ..... cubic yards..... 25,746,683  
 Required to bring levees to grade and section ..... do ..... <sup>2</sup>13,950,500  
 Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years..... 15,128,000  
 Miles of levee above highest water:  
 Less than 1 foot ..... 12.73  
 From 1 to 2 feet ..... 47.70  
 From 2 to 3 feet ..... 23.10  
 From 3 to 4 feet ..... 19.36  
 From 4 to 5 feet ..... None.  
 Miles of levee up to grade, but deficient in section ..... 17.72  
 Miles of levee up to full grade and section ..... 7.26

Levees built by local authorities contain earth not applying toward the completion of the project and require additional earth to be made of specified dimensions.

*Local cooperation.*—Local authorities have expended, in part, and between 1882 and January 1, 1917, \$10,527,733.54 in building, improving, and maintaining levee lines. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no account of them has been discovered.

*Proposed operations.*—The project is 35.5 per cent uncompleted. The work proposed for the next year consists of completing the work now in progress or under contract. The object of this work is to complete, in accordance with the subprojects, the levees which form the weakest and most troublesome portion of the line near its head.

<sup>1</sup> Does not include 38,700 cubic yards of earth placed in new levee at Belle Vista by the local authorities.

<sup>2</sup> Does not include 929,233 cubic yards under contract, of which 493,513 cubic yards are new work.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                   |                   |
|-----------------------------------|-------------------|
| New work                          | \$2, 073, 999. 20 |
| Maintenance                       | 150, 067. 12      |
| Total expended                    | 2, 224, 066. 41   |
| Total appropriation June 30, 1917 | 2, 403, 185. 56   |

| Fiscal year ending June 30. | 1913         | 1914         | 1915        | 1916        | 1917         |
|-----------------------------|--------------|--------------|-------------|-------------|--------------|
| Expended for new work       | \$106,345.13 | \$137,557.26 | \$66,418.47 | \$54,058.58 | \$112,137.69 |
| Expended for maintenance    | 969.50       | 1,825.37     |             | 20,338.66   |              |
| Total expended              | 107,314.63   | 139,382.63   | 66,418.47   | 74,397.24   | 112,137.69   |
| Appropriated or allotted    | 97,500.00    | 125,000.00   | 85,000.00   | 171,075.90  |              |

|                                                                    |              |
|--------------------------------------------------------------------|--------------|
| July 1, 1916, balance unexpended                                   | \$141,256.84 |
| Amount appropriated by river and harbor act approved July 27, 1916 | 150,000.00   |

|                                                                                                   |            |
|---------------------------------------------------------------------------------------------------|------------|
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for new work | 291,256.84 |
|                                                                                                   | 112,137.69 |

|                                                       |            |
|-------------------------------------------------------|------------|
| July 1, 1917, balance unexpended                      | 179,119.15 |
| July 1, 1917, outstanding liabilities                 | \$327.45   |
| July 1, 1917, amount covered by uncompleted contracts | 146,226.56 |
|                                                       | 146,554.01 |

|                                                                      |           |
|----------------------------------------------------------------------|-----------|
| July 1, 1917, balance available for fiscal year ending June 30, 1918 | 32,565.14 |
|----------------------------------------------------------------------|-----------|

*Abstract of appropriations.*

| Act of Congress.                                                                                              | Allotted.     | Amount.      |
|---------------------------------------------------------------------------------------------------------------|---------------|--------------|
| "ATCHAFALAYA FRONT."                                                                                          |               |              |
| Aug. 2, 1882 (river and harbor)                                                                               |               | \$110,000.00 |
| Jan. 19, 1884 (river and harbor)                                                                              |               | 5,000.00     |
| Do                                                                                                            |               | 4,000.00     |
| Do                                                                                                            |               | 15,000.00    |
| Do                                                                                                            |               | 12,800.00    |
| Aug. 3, 1886 (river and harbor)                                                                               |               | 40,000.00    |
|                                                                                                               |               | 176,800.00   |
| "LEVEES, RIGHT BANK BELOW RED RIVER."                                                                         |               |              |
| Sept. 19, 1890 (river and harbor)                                                                             | Dec. 4, 1890  | 123,975.00   |
| Do                                                                                                            | (2)           | 41,562.50    |
| Do                                                                                                            | (2)           | 12,468.75    |
| Do                                                                                                            | (2)           | 1,411.15     |
|                                                                                                               |               | 179,447.40   |
| "PROTECTION OF LEVEES, RIGHT BANK BELOW RED RIVER."                                                           |               |              |
| Sept. 19, 1890 (river and harbor)                                                                             |               | 6,222.30     |
| "PROTECTION OF LEVEES, FOURTH DISTRICT."                                                                      |               |              |
| Apr. 11, 1888 (river and harbor)                                                                              |               | 23,663.00    |
| "ATCHAFALAYA LEVEE DISTRICT."                                                                                 |               |              |
| July 13, 1892 (river and harbor)                                                                              | Aug. 10, 1892 | 155,000.00   |
| Apr. 3, 1893 (sundry civil)                                                                                   | May 18, 1893  | 152,000.00   |
| Apr. 18, 1894 (sundry civil)                                                                                  |               | 147,366.96   |
| Apr. 2, 1895 (sundry civil)                                                                                   |               | 148,960.00   |
| Original allotment, \$12,000; \$9,200 transferred to Tensas front, New Orleans Harbor and mouth of Red river. |               |              |
| By transfer.                                                                                                  |               |              |
| Original allotment, \$152,000; \$4,633.04 transferred to Pontchartrain levee district.                        |               |              |
| Original allotment, \$152,000; \$3,040 transferred to Homochitto levee district.                              |               |              |

*Abstract of appropriations—Continued.*

| Act of Congress.                        | Allotted.     | Amount.      |
|-----------------------------------------|---------------|--------------|
| "ATCHAFALAYA LEVEE DISTRICT"—continued. |               |              |
| June 3, 1896 (river and harbor).....    | June —, 1896  | \$28,125.00  |
| June 4, 1897 (sundry civil).....        | Aug. 20, 1897 | 138,600.00   |
| July 19, 1897 (deficiency).....         | July 19, 1897 | 28,125.00    |
| July 1, 1898 (sundry civil).....        | Mar. 10, 1898 | 70,000.00    |
| Do.....                                 | June 29, 1898 | 17,000.00    |
| Mar. 3, 1899 (sundry civil).....        | Mar. 13, 1899 | 98,800.00    |
| June 6, 1900 (sundry civil).....        | July 20, 1900 | 55,000.00    |
| June 13, 1902 (river and harbor).....   | July 12, 1902 | 40,000.00    |
| Mar. 3, 1903 (sundry civil).....        | Nov. 25, 1903 | 40,000.00    |
| Apr. 28, 1904 (sundry civil).....       | July 21, 1903 | 40,000.00    |
| Mar. 3, 1905 (sundry civil).....        | July 29, 1905 | 40,000.00    |
| Mar. 3, 1905 (river and harbor).....    | Apr. 26, 1905 | 30,000.00    |
| June 30, 1906 (sundry civil).....       | June 28, 1906 | 25,000.00    |
| Mar. 2, 1907 (river and harbor).....    | Mar. 27, 1907 | 30,000.00    |
| June 25, 1910 (sundry civil).....       | Apr. 30, 1910 | 32,000.00    |
| June 25, 1910 (river and harbor).....   | July 6, 1910  | 122,500.00   |
| July 25, 1912 (river and harbor).....   | Aug. 3, 1912  | 200,000.00   |
| Mar. 4, 1913 (river and harbor).....    | Apr. 30, 1913 | 297,500.00   |
| Oct. 2, 1914 (river and harbor).....    | Oct. 15, 1914 | 125,000.00   |
| Mar. 4, 1915 (river and harbor).....    | Apr. 18, 1915 | 85,000.00    |
| July 27, 1916 (river and harbor).....   | Aug. 14, 1916 | 417,075.90   |
|                                         |               | 2,017,052.80 |
| Grand total.....                        |               | 2,403,185.50 |

<sup>1</sup> Original allotment, \$25,000; \$2,500 transferred to Barataria levee district.<sup>2</sup> Original allotment, \$150,000; \$15,500 transferred to Lower Tensas levee district, \$22,000 transferred to Barataria levee district, \$15,000 transferred to Lafourche levee district.<sup>3</sup> Original allotment, \$92,000; \$17,000 transferred to harbors at Natchez and Vidalia, Miss. and La. B transfer, \$10,000.<sup>4</sup> By transfer, Jan. 26, 1917, for construction of steel barge, \$21,075.90.*Contracts in force.*

| Name of contractor.           | Amount of work. | Character of work.       | Unit price.   | Date of approval. |
|-------------------------------|-----------------|--------------------------|---------------|-------------------|
|                               |                 |                          | <i>Cents.</i> |                   |
| Grasser Contracting Co.....   | \$197,871.90    | Enlargement.....         | 13.47         | Nov. 20, 1916     |
| Do.....                       | 240,767.19      | New.....                 | 13.47         | Do.               |
| Do.....                       | 255,574.93      | New and enlargement..... | 13.47         | Do.               |
| Gibson, Hamilton & Co.....    | 104,168.70      | Enlargement.....         | 9.23          | Nov. 13, 1916     |
| Do.....                       | 104,410.18      | do.....                  | 9.23          | Do.               |
| Do.....                       | 101,616.02      | do.....                  | 9.23          | Do.               |
| Dameron-White Co. (Ltd.)..... | 104,841.73      | do.....                  | 11.89         | Apr. 27, 1917     |

| Name of contractor.         | Date of beginning. | Date of expiration. | Per cent complete. | Name of levee.       | Miles below Cairo |
|-----------------------------|--------------------|---------------------|--------------------|----------------------|-------------------|
| Grasser Contracting Co..... | Apr. 1, 1917       | Jan. 31, 1918       | .....              | Red River Landing... | 765 R             |
| Do.....                     | do.....            | do.....             | .....              | Smithland.....       | 766.5 R           |
| Do.....                     | do.....            | do.....             | 11.7               | Henrietta.....       | 767.8 R           |
| Gibson, Hamilton & Co.....  | Oct. 12, 1915      | Dec. 15, 1916       | 45                 | Batchelor.....       | 772 R             |
| Do.....                     | do.....            | do.....             | 9.3                | Normandy.....        | 773.5 R           |
| Do.....                     | do.....            | do.....             | .....              | Unique.....          | 775 R             |
| Dameron-White Co. (Ltd.)... | Apr. 5, 1915       | Feb. 1, 1916        | 89                 | Lacour, lot 2.....   | 780 R             |

*(c) Lafourche levee district.*

*Location.*—The Lafourche levee district extends on the right bank from Bayou Lafourche, 886 miles below Cairo, to New Orleans, 964 miles below Cairo, with a river frontage of 78 miles. The Lafourche and Barataria levee districts comprise the same basin, with a total area of 2,020 square miles. The levee line is continuous, 82.14 miles in length, all of which has been built.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Present project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, land slope one on three to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results prior to the present year.*—Under the present project work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. As work has progressed on the project a constantly increasing amount of protection has been afforded by the levees. The levee line was closed previous to 1884. Information as to conditions in 1882 is lacking. Crevasses have occurred as follows:

|      |   |
|------|---|
| 1884 | 4 |
| 1890 | 1 |
| 1892 | 3 |
| 1903 | 1 |
| 1912 | 1 |

Three of the breaks which occurred in 1884 were promptly closed. The uncompleted project has afforded complete protection for 24 out of the past 27 years. The amounts spent for new work and for maintenance prior to the beginning of the present fiscal year are \$777,676.54 and \$208,723.87, respectively, a total of \$986,400.41.

*Operations and results during the present year.*—Construction was continued by contract and by hired labor. The work under construction and the progress thereon is shown in the following table and has resulted in increased protection against floods:

| Name of levee. | Kind of work.          | Miles below Cairo. | Length.      | Average height. | In contract.        |
|----------------|------------------------|--------------------|--------------|-----------------|---------------------|
|                |                        |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Salsburg.....  | New.....               | 897 R.             | 1,010        | 15.1            | 150,721.33          |
| Willswood..... | New and enlarging..... | 952-6 R.           | 21,003       | 17.5            | 457,000.00          |
| Total.....     |                        |                    |              |                 | 607,721.33          |

| Name of levee. | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.       | Required to complete. |
|----------------|---------------------|-----------------------|-----------------------|-------------|-----------------------|
|                | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |             | <i>Cubic yards.</i>   |
| Salsburg.....  | 150,721.33          | 150,721.33            | 10.80                 | \$16,312.82 | 360,704               |
| Willswood..... | 96,296.00           | 88,850.88             | 10.23                 | 9,089.45    |                       |
| Total.....     | 247,017.33          | 239,572.21            |                       | 25,402.27   |                       |

<sup>1</sup> Field cost by hired labor.

Machine (Buras)—Location (Salsburg):

|                   |            |
|-------------------|------------|
| Mobilization..... | \$1,237.91 |
| Clearing.....     | 180.00     |
| Plowing.....      | 142.50     |
| Operation.....    | 10,179.80  |
| Repairs.....      | 4,282.06   |
| Dressing.....     | 206.28     |
| Sodding.....      | 62.52      |
| Surveys.....      | 21.75      |
| Depreciation..... | 2,750.64   |
| Overhead.....     | 288.12     |
| Total cost.....   | 19,351.58  |

|                    |        |            |
|--------------------|--------|------------|
| Handled.....       | yards. | 150,721.33 |
| Cost per yard..... | cents. | 12.84      |

Work was done by hired labor. Work on the various levees was commenced and finished as follows:

| Name of levee. | Miles below Cairo. | Work commenced. | Work finished. | Remarks.                   |
|----------------|--------------------|-----------------|----------------|----------------------------|
| Salsburg.....  | 897 R.             | Aug. 20, 1916   | Nov. 20, 1916  |                            |
| Willwood.....  | 952-6 R.           | Dec. 21, 1916   |                | In course of construction. |

The total work done by the United States and local authorities is as follows:

|                                       |                  |         |
|---------------------------------------|------------------|---------|
| Constructed by the United States..... | cubic yards..... | 247,017 |
| Constructed by local authorities..... | do.....          | 884,482 |

|                                                   |         |           |
|---------------------------------------------------|---------|-----------|
| Total constructed during the year.....            | do..... | 1,131,499 |
| Percentage of work done by the United States..... |         | 21.83     |

The effect has been to give increased security against floods. The completed levee line is 10.21 miles in length.

*Condition at end of present year.*—The following is the condition of the levees at the end of the present year (May 31, 1917):

|                                                                                                                                        |                         |                        |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------|
| Project for earthwork.....                                                                                                             | per cent completed..... | 70.4                   |
| Miles in system.....                                                                                                                   |                         | 82.14                  |
| Miles built.....                                                                                                                       |                         | 82.14                  |
| Yardage lost during the year.....                                                                                                      | cubic yards.....        | 517,071                |
| Contents of levee (May 31, 1917).....                                                                                                  | do.....                 | 12,634,839             |
| Required to bring levees to grade and section.....                                                                                     | do.....                 | <sup>1</sup> 4,628,217 |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years..... | cubic yards.....        | 5,311,096              |
| Miles of levees above highest water:                                                                                                   |                         |                        |
| Less than 1 foot.....                                                                                                                  |                         | 2.41                   |
| From 1 to 2 feet.....                                                                                                                  |                         | 14.21                  |
| From 2 to 3 feet.....                                                                                                                  |                         | 26.85                  |
| From 3 to 4 feet.....                                                                                                                  |                         | 17.51                  |
| From 4 to 5 feet.....                                                                                                                  |                         | None.                  |
| Miles of levees up to full grade but deficient in section.....                                                                         |                         | 10.91                  |
| Miles of levees up to full grade and section.....                                                                                      |                         | 10.21                  |

Levees built by local authorities contain earth not applying toward completion of project and require additional earth to be made of specified dimensions.

*Local cooperation.*—Local authorities have expended in part and between 1882 and January 1, 1917, \$5,835,312.49 in building, improving, and maintaining levee lines. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered.

*Proposed operations.*—The project is 29.6 per cent uncompleted. The work proposed for the next year consists of completing the work now in progress and extending this line as far downstream as available funds will permit. The object of this work is to secure the levee line at its head.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales etc., formerly included:

|                                            |              |
|--------------------------------------------|--------------|
| New work.....                              | \$923,892.37 |
| Maintenance.....                           | 101,803.22   |
| Total expended.....                        | 1,025,695.59 |
| Total appropriations to June 30, 1917..... | 1,105,551.06 |

<sup>1</sup> Recent levels made in change in last year's estimate.

| Fiscal year ending June 30.   | 1913        | 1914         | 1915        | 1916        | 1917        |
|-------------------------------|-------------|--------------|-------------|-------------|-------------|
| Expended for new work.....    | \$72,860.66 | \$119,931.38 | \$77,715.78 | \$22,507.55 | \$35,673.99 |
| Expended for maintenance..... | 2,797.03    | 1,009.07     |             | 13,565.69   |             |
| Total expended.....           | 75,657.69   | 120,940.45   | 77,715.78   | 36,073.24   | 35,673.99   |
| Appropriated or allotted..... | 75,000.00   | 100,000.00   | 25,000.00   | 100,000.00  |             |

|                                                                                                        |                   |
|--------------------------------------------------------------------------------------------------------|-------------------|
| July 1, 1916, balance unexpended.....                                                                  | \$15,529.46       |
| Amount appropriated by river and harbor act approved July 27, 1916.....                                | 100,000.00        |
|                                                                                                        | <u>115,529.46</u> |
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for new work..... | 35,673.99         |
| July 1, 1917, balance unexpended.....                                                                  | 79,855.47         |
| July 1, 1917, outstanding liabilities.....                                                             | \$4,568.86        |
| July 1, 1917, amount covered by uncompleted contracts.....                                             | 47,427.96         |
|                                                                                                        | <u>51,996.82</u>  |
| July 1, 1917, balance available for fiscal year ending June 30, 1918.....                              | 27,858.65         |

*Abstract of appropriations.*

| Act of Congress.                                    | Allotted.        | Amount.                |
|-----------------------------------------------------|------------------|------------------------|
| "PROTECTION OF LEVEES, RIGHT BANK BELOW RED RIVER." |                  |                        |
| Sept. 19, 1890 (river and harbor).....              |                  | \$6,222.30             |
| "PROTECTION OF LEVEES, FOURTH DISTRICT."            |                  |                        |
| Aug. 11, 1888 (river and harbor).....               |                  | 32,536.62              |
| "LAFOURCHE LEVEE DISTRICT."                         |                  |                        |
| July 13, 1892 (river and harbor).....               | Aug. 10, 1892    | 90,000.00              |
| Mar. 3, 1893 (sundry civil).....                    | May 18, 1893     | 90,000.00              |
| Aug. 18, 1894 (sundry civil).....                   |                  | 90,000.00              |
| Mar. 2, 1895 (sundry civil).....                    |                  | 188,200.00             |
| June 3, 1896 (river and harbor).....                | June —, 1896     | 8,437.50               |
| June 4, 1897 (sundry civil).....                    | Aug. 20, 1897    | 41,600.00              |
| July 19, 1897 (deficiency).....                     | July 19, 1897    | 8,437.50               |
| July 1, 1898 (sundry civil).....                    | Mar. 10, 1898    | 24,000.00              |
| Do.....                                             | June 29, 1898    | 12,000.00              |
| Mar. 3, 1899 (sundry civil).....                    | Mar. 13, 1899    | 37,050.00              |
| June 6, 1900 (sundry civil).....                    | July 20, 1900    | 28,000.00              |
| June 13, 1902 (river and harbor).....               | July 12, 1902    | 20,000.00              |
| Mar. 3, 1903 (sundry civil).....                    | Nov. 25, 1903    | 20,000.00              |
| Apr. 28, 1904 (sundry civil).....                   | July 21, 1903    | 40,000.00              |
| Mar. 3, 1905 (river and harbor).....                | Apr. 26, 1905    | 15,000.00              |
| Mar. 3, 1905 (sundry civil).....                    | July 25, 1905    | <sup>2</sup> 21,067.14 |
| June 25, 1910 (river and harbor).....               | July 6, 1910     | 13,000.00              |
| July 25, 1912 (river and harbor).....               | Aug. 3, 1912     | 120,000.00             |
| Mar. 4, 1913 (river and harbor).....                | Apr. 30, 1913    | 60,000.00              |
| Do.....                                             | ( <sup>3</sup> ) | 15,000.00              |
| Oct. 2, 1914 (river and harbor).....                | Oct. 15, 1914    | 100,000.00             |
| Mar. 4, 1915 (river and harbor).....                | Apr. 18, 1915    | <sup>4</sup> 25,000.00 |
| July 27, 1916 (river and harbor).....               | Aug. 14, 1916    | 100,000.00             |
|                                                     |                  | <u>1,066,792.14</u>    |
| Grand total.....                                    |                  | 1,105,551.06           |

<sup>1</sup> Original allotment, \$90,000; \$1,800 transferred to Homochitto levee district.<sup>2</sup> Original allotment, \$40,000; \$18,932.86 transferred to Lower Tensas levee district.<sup>3</sup> By transfer.<sup>4</sup> Original allotment, \$50,000; \$10,000 transferred to harbors at Natchez and Vidalia, Miss., and La., \$5,000 transferred to Lower Tensas levee district; \$10,000 transferred to Barataria levee district.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. The work can not be allowed to remain without further cooperation. Complete protection is not yet afforded and any delay may cause serious damage.

*Contracts in force.*

| Name of contractor. | Amount of work (yards). | Character of work.   | Unit price (cents). | Date of approval. |
|---------------------|-------------------------|----------------------|---------------------|-------------------|
| O. O. Ogden.....    | 457,000                 | New and enlargement. | 10.23               | Dec. 13, 1916     |

| Name of contractor. | Date of beginning. | Date of expiration. | Per cent complete. | Name of levee. | Miles below Cairo. |
|---------------------|--------------------|---------------------|--------------------|----------------|--------------------|
| O. O. Ogden.....    | Dec. 21, 1916      | Jan. 31, 1917       | 21.1               | Willswood..... | 952-6 R.           |

*(d) Barataria levee district.*

*Location.*—The Barataria levee district extends on the right bank from the lower limits of New Orleans, 981.5 miles below Cairo, to the Head of the Passes, 1,064 miles below Cairo, with a river frontage of 82.5 miles. The levee line is continuous to the Jump, 71.12 miles. The total area protected in this and the Lafourche district is 2,020 square miles.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Present project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results prior to the fiscal year.*—Under the present project work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. As work has progressed on the project, a constantly increasing amount of protection has been afforded by the levees. The following crevasses have occurred:

|           |   |
|-----------|---|
| 1882..... | 3 |
| 1884..... | 1 |
| 1890..... | 8 |
| 1892..... | 3 |
| 1893..... | 2 |
| 1897..... | 1 |
| 1903..... | 3 |
| 1907..... | 1 |
| 1912..... | 1 |

The break which occurred in 1912 was promptly closed before serious damage had occurred. The amounts spent for new work and for maintenance prior to the beginning of the fiscal year are \$650,866.22 and \$112,290.70, respectively, a total of \$763,156.92.

Operations and results during the present year.—Construction was continued by hired labor, adding 137,511 cubic yards to the levee line as shown in the following table:

| Name of levee.          | Kind of work.            | Miles below Cairo. | Length.      | Average height. | In contract.        |
|-------------------------|--------------------------|--------------------|--------------|-----------------|---------------------|
|                         |                          |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Myrtle Grove.....       | New.....                 | 1,005 R.           | 3,215        | 11.8            | 65,103.00           |
| Magnolia to Socola..... | Enlargement.....         | 1,018 R.           | 5,000        | 9.1             | 37,349.36           |
| Lower Rice and.....     | New and enlargement..... | 1,019 R.           | 3,490        | 12.2            | 44,349.23           |
| Rhoday to Reddick.....  | do.....                  | 1,038-41 R.        | 19,916       | 8.0             | 95,462.75           |
| Total.....              |                          |                    |              |                 | 242,264             |

| Name of levee.          | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.                  | Required to complete. |
|-------------------------|---------------------|-----------------------|-----------------------|------------------------|-----------------------|
|                         | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |                        | <i>Cubic yards.</i>   |
| Myrtle Grove.....       | 1,200.00            | 1,200.00              | 14.82                 | <sup>1</sup> \$177.84  |                       |
| Magnolia to Socola..... | 8,182.22            | 8,182.22              | 12.49                 | <sup>1</sup> 1,021.84  |                       |
| Lower Rice and.....     | 42,349.23           | 42,349.23             | 16.00                 | <sup>1</sup> 6,777.39  | 2,000.00              |
| Rhoday to Reddick.....  | 85,779.69           | 85,779.69             | 14.48                 | <sup>1</sup> 12,425.18 | 9,683.06              |
| Total.....              | 137,511.14          | 137,511.14            |                       | 20,402.25              |                       |

<sup>1</sup> Field cost by hired labor.

At Star (996-S-R.) 2,474.26 square yards of concrete revetment were placed at a cost of \$4,392.43.

The following repairs were made by hired labor:

At Star (996-S-R.) 8,200 linear feet of wooden revetment at a cost of \$238.50.

At Myrtle Grove (1005-R.) 1,333.33 square yards of concrete revetment at a cost of \$2,319.72.

At Myrtle Grove (1005-R.) 4,000 linear feet of wooden revetment at a cost of \$741.93.

At Lower Riceland (1004-R.) 1,208.60 square yards of concrete revetment at a cost of \$2,492.80.

At Lower Riceland (1004-R.) 7,960 linear feet of wooden revetment at a cost of \$741.93.

| Machine and location.   | Mobilization. | Clearing. | Drainage. | Plowing. | Operation. | Repairs. | Dressing.        |
|-------------------------|---------------|-----------|-----------|----------|------------|----------|------------------|
| Barataria:              |               |           |           |          |            |          |                  |
| Myrtle Grove.....       | \$80.63       |           |           |          | \$87.21    |          | \$8.00           |
| Magnolia to Socola..... | 186.80        |           |           |          | 835.04     |          | ( <sup>1</sup> ) |
| Lower Rice and.....     | 1,048.00      | \$116.16  | \$8.40    | \$39.75  | 4,479.95   | \$452.66 | 592.07           |
| Rhoday to Reddick.....  | 964.50        | 1,045.10  | 42.00     | 63.00    | 8,068.81   | 864.00   | 1,205.26         |

| Machine and location.   | Sodding. | Surveys. | Depreciation. | Overhead. | Total cost. | Handled.      | Cost per yard. |
|-------------------------|----------|----------|---------------|-----------|-------------|---------------|----------------|
| Barataria:              |          |          |               |           |             | <i>Yards.</i> | <i>Cents.</i>  |
| Myrtle Grove.....       | \$2.00   |          | \$46.92       | \$24.10   | \$248.86    | 1,200.00      | 20.74          |
| Magnolia to Socola..... |          |          | 130.70        | 168.94    | 1,321.48    | 8,182.22      | 16.15          |
| Lower Rice and.....     | 32.00    | \$8.40   | 1,091.31      | 857.90    | 8,726.60    | 42,349.23     | 20.61          |
| Rhoday to Reddick.....  | 88.00    | 84.51    | 3,524.70      | 1,829.84  | 17,779.72   | 85,779.69     | 20.72          |

<sup>1</sup> Not yet dressed.

Work was done by contract and hired labor. Work on the various levees was commenced and finished as follows:

| Name of levee.          | Miles below Cairo. | Work commenced. | Work finished.      |
|-------------------------|--------------------|-----------------|---------------------|
| Myrtle Grove.....       | 1,005 R.           | Nov. 8, 1915    | June 14, 1917       |
| Magnolia to Socola..... | 1,018 R.           | July 21, 1915   | June 6, 1917        |
| Lower Riceland.....     | 1,019 R.           | Dec. 12, 1916   | Under construction. |
| Rhodey to Reddick.....  | 1,038-41 R.        | Jan. 19, 1917   | Do.                 |

The total work done by the United States and local authorities is as follows:

|                                        |                   |          |
|----------------------------------------|-------------------|----------|
| Constructed by the United States ..... | cubic yards ..... | 137,511  |
| Constructed by local authorities ..... | do .....          | 189, 281 |

|                                                    |          |          |
|----------------------------------------------------|----------|----------|
| Total constructed during the year .....            | do ..... | 326, 792 |
| Percentage of work done by the United States ..... | .....    | 42. 08   |

The result of the work has been to give increased security against floods.

The completed line is 30.50 miles in length.

*Conditions at end of present year.*—The following is the condition of the levees at the end of the present year (May 31, 1917):

|                                                                                                                                         |                          |             |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|
| Project for earthwork .....                                                                                                             | per cent completed ..... | 81. 1       |
| Miles in system .....                                                                                                                   | .....                    | 71. 12      |
| Miles built .....                                                                                                                       | .....                    | 71. 12      |
| Yardage lost during year by abandoning old levees .....                                                                                 | cubic yards .....        | 74, 015     |
| Contents of levees, May 31, 1917 .....                                                                                                  | do .....                 | 4, 792, 433 |
| Required to bring levees to grade and section .....                                                                                     | do .....                 | 968, 265    |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years ..... | cubic yards .....        | 1, 222, 265 |
| Miles of levees above highest water:                                                                                                    |                          |             |
| Less than 1 foot .....                                                                                                                  | .....                    | 2. 24       |
| From 1 to 2 feet .....                                                                                                                  | .....                    | 9. 71       |
| From 2 to 3 feet .....                                                                                                                  | .....                    | 19. 93      |
| From 3 to 4 feet .....                                                                                                                  | .....                    | 6. 77       |
| Miles of levees up to grade but deficient in section .....                                                                              | .....                    | 2. 97       |
| Miles of levees up to grade and section .....                                                                                           | .....                    | 30. 50      |

*Local cooperation.*—Local authorities have expended, in part and between 1882 and January 1, 1917, \$720,253.53 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered.

*Proposed operations.*—The project is 18.9 per cent uncompleted. The work proposed for the next year consists of completing the work now in progress and in extending the completed line, as nearly as practicable, continuously downstream. The object of this work is protection for the head of the line and to extend the protection as far as possible.

*Effect of improvement.*—The effect of the work has been to give added protection again floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded and any delay may cause serious damage.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                             |                |
|---------------------------------------------|----------------|
| New work .....                              | \$725, 248. 05 |
| Maintenance .....                           | 111, 331. 27   |
| Total expended .....                        | 836, 579. 32   |
| Total appropriations to June 30, 1917 ..... | 904. 722. 87   |

| Fiscal year ending June 30.   | 1913        | 1914        | 1915        | 1916        | 1917        |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work.....    | \$21,721.96 | \$80,832.42 | \$63,210.15 | \$62,626.41 | \$42,458.58 |
| Expended for maintenance..... | 24,481.22   | 6,580.25    | 1,572.49    | 10,536.69   | .....       |
| Total expended.....           | 46,203.18   | 87,412.67   | 64,782.64   | 73,163.10   | 42,458.58   |
| Appropriated or allotted..... | 72,000.00   | 75,000.00   | 60,000.00   | 95,000.00   | .....       |

July 1, 1916, balance unexpended.....\$15,602.13

Amount appropriated by river and harbor act approved July 27, 1916.....95,000.00

110,602.13

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for new work.....42,458.58

July 1, 1917, balance unexpended.....68,143.55

July 1, 1917, outstanding liabilities.....528.99

July 1, 1917, balance available for fiscal year ending June 30, 1918.....67,614.56

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.     | Amount.    |
|---------------------------------------|---------------|------------|
| PROTECTION OF LEVEES—FOURTH DISTRICT. |               |            |
| Aug. 11, 1888 (river and harbor)..... |               | \$2,947.87 |
| BARATARIA LEVEE DISTRICT.             |               |            |
| July 13, 1892 (river and harbor)..... | Aug. 10, 1892 | 60,000.00  |
| Mar. 3, 1893 (sundry civil).....      | May 18, 1893  | 60,000.00  |
| Aug. 18, 1894 (sundry civil).....     | .....         | 60,000.00  |
| Mar. 3, 1895 (sundry civil).....      | .....         | 158,800.00 |
| June 3, 1896 (river and harbor).....  | July 19, 1897 | 3,937.50   |
| June 4, 1897 (sundry civil).....      | Aug. 20, 1897 | 19,400.00  |
| July 19, 1897 (deficiency).....       | July 19, 1897 | 3,937.50   |
| July 1, 1898 (sundry civil).....      | Mar. 10, 1898 | 15,000.00  |
| Do.....                               | June 29, 1898 | 12,000.00  |
| Mar. 3, 1899 (sundry civil).....      | Mar. 13, 1899 | 24,700.00  |
| June 6, 1900 (sundry civil).....      | July 20, 1900 | 14,000.00  |
| June 13, 1902 (river and harbor)..... | July 12, 1902 | 10,000.00  |
| Mar. 3, 1903 (sundry civil).....      | Nov. 25, 1903 | 10,000.00  |
| Apr. 28, 1904 (sundry civil).....     | June 25, 1903 | 15,000.00  |
| Mar. 3, 1905 (sundry civil).....      | Apr. 26, 1905 | 15,000.00  |
| Mar. 3, 1905 (river and harbor).....  | July 29, 1905 | 15,000.00  |
| June 30, 1906 (sundry civil).....     | June 28, 1906 | 10,000.00  |
| Mar. 2, 1907 (river and harbor).....  | Mar. 27, 1907 | 25,000.00  |
| May 27, 1908 (sundry civil).....      | May 4, 1908   | 40,000.00  |
| June 25, 1910 (sundry civil).....     | Apr. 30, 1910 | 25,000.00  |
| June 25, 1910 (river and harbor)..... | (2)           | 2,500.00   |
| June 25, 1910 (sundry civil).....     | (2)           | 7,500.00   |
| Do.....                               | (2)           | 1,000.00   |
| Feb. 27, 1911 (river and harbor)..... | July 8, 1911  | 12,000.00  |
| July 25, 1912 (river and harbor)..... | Aug. 3, 1912  | 80,000.00  |
| Mar. 4, 1913 (river and harbor).....  | Apr. 30, 1913 | 50,000.00  |
| Do.....                               | (2)           | 12,000.00  |
| Do.....                               | (2)           | 10,000.00  |
| Oct. 2, 1914 (river and harbor).....  | Oct. 15, 1914 | 75,000.00  |
| Mar. 4, 1915 (river and harbor).....  | Apr. 18, 1915 | 60,000.00  |
| July 27, 1916 (river and harbor)..... | Aug. 14, 1916 | 95,000.00  |
| Total.....                            |               | 904,722.87 |

<sup>1</sup> Original allotment, \$60,000; \$1,200 transferred to Homochitto levee district.

<sup>2</sup> By transfer.

*Contracts in force.*—None.

*(c) Homochitto levee district.*

*Location.*—The Homochitto levee district extends on the left bank, in continuation of the Lower Yazoo district, from the mouth of the Yazoo River, 559 miles below Cairo, to Baton Rouge, 834 miles below Cairo, with a river frontage

of 234 miles and an area of 233 square miles. There is no continuous levee line; several disconnected short levees exist, and loops are built at Rodney and Coles Creek, 659 to 666 miles below Cairo; Palmetto Point, 745 to 752 miles below Cairo; Angola State farm, 764 to 770 miles below Cairo; and Bayou Sara, 800 miles below Cairo. The total length of these levees is 39.77 miles.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The levees were all built by property owners previous to 1912.

*Previous project.*—No project for work by the United States existed previous to 1912. In 1912 and 1913 the project adopted by the Mississippi River Commission was to rebuild levees damaged by the flood of 1912. This project was completed in 1912.

*Present project.*—None.

*Operations and results prior to the present year.*—Under the project of 1912 and 1913, \$23,402.56 was expended in rebuilding broken levees between Vicksburg, Miss., and Bayou Sara, La. The effect of this work was to restore the levees to the condition in which they were previous to the flood of 1912.

*Operations and results during the present year.*—None.

*Condition at end of present year.*—With the exception of the 13.1 miles of levee around Angola State farm, all levees are below grade and deficient in section. A detailed survey has not been made. In case of an extreme flood the levee line would probably be broken at many places.

*Local cooperation.*—The levees have been built and maintained by the property owners. No record of their cost is available.

*Effect of improvement.*—The effect of the improvement already made is to give as large a measure of protection as the value of the lands behind the levees will justify.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                            |           |
|--------------------------------------------|-----------|
| New work.....                              | \$2,501.2 |
| Maintenance.....                           | 5.0       |
| Total expended.....                        | 2,506.2   |
| Total appropriations to June 30, 1917..... | 3,000.0   |

| Fiscal year ending June 30.   |  | 1910.      | 1912. |
|-------------------------------|--|------------|-------|
| Expended for new work.....    |  | \$2,501.22 |       |
| Expended for maintenance..... |  |            | \$5.0 |
| Total expended.....           |  | 2,501.22   | 5.0   |
| Appropriated or allotted..... |  | 3,000.00   |       |

|                                                             |         |
|-------------------------------------------------------------|---------|
| July 1, 1916, balance unexpended.....                       | \$493.7 |
| Balance available for fiscal year ending June 30, 1918..... | 493.7   |

#### Abstract of appropriations.

| Act of Congress.                      | Allotted.    | Amount.   |
|---------------------------------------|--------------|-----------|
| June 25, 1910 (river and harbor)..... | July 6, 1910 | \$3,000.0 |

*Contracts in force.*—None.

#### (f) Pontchartrain levee district.

*Location.*—The Pontchartrain levee district extends on the left bank from the lower limits of Baton Rouge, 834 miles below Cairo, to New Orleans, 957 miles below Cairo, with a river frontage of 123.5 miles. The levee line is continuous, and is 125.33 miles in length. The Pontchartrain and Lake Borgne levee districts comprise the same basin, which has a total area of 1,816 square miles.

*Original condition.*—Originally there were no levees, and the country was subject to overflow. The first levees were built by riparian owners, under a Spanish law, which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Present project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, land slope one on three to 8 feet below crown, and thence a banquette of varying widths, from 20 to 40 feet, dependent on the height of the levee.

*Operation and results prior to the fiscal year.*—Under the present project work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. As work has progressed on the project, a constantly increasing amount of protection has been afforded by the levees. The gaps in the levee line were closed by the State in 1882. Since then crevasses have occurred, as follows:

|      |   |
|------|---|
| 1882 | 2 |
| 1884 | 2 |
| 1890 | 2 |
| 1892 | 5 |
| 1893 | 4 |
| 1897 | 1 |

Of the four breaks which occurred in 1893, three were promptly closed. The uncompleted work has afforded continuous protection for the past 20 years, during which time two of the greatest floods known have been successfully passed. The amounts spent for new work and for maintenance prior to the beginning of the fiscal year are \$1,988,226.87 and \$180,051.16, respectively, a total of \$2,168,278.03.

*Operation and results during the present year.*—Construction was continued by contract and hired labor. The work done has finished 7.56 miles of levee, giving increased protection against floods and has been as shown in the following table:

| Name of levee.            | Character of work.   | Miles below Cairo. | Length.      | Average height. | In contract.        |
|---------------------------|----------------------|--------------------|--------------|-----------------|---------------------|
|                           |                      |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Arlington.....            | Enlargement.....     | 837 L.             | 5,639        | 21.8            | 153,242.40          |
| Shannon.....              | New.....             | 838 L.             | 2,753        | 20.5            | 182,713.59          |
| Ben Hur.....              | Enlargement.....     | 845 L.             | 8,300        | 19.5            | 230,047.87          |
| Ben Hur to Burtville..... | New and enlargement. | 845-7 L.           | 12,079       | 18.1            | 375,000.00          |
| Towles.....               | do.....              | 850-3 L.           | 12,940       | 18.0            | 408,164.66          |
| Southwood.....            | Enlargement.....     | 876 L.             | 3,572        | 17.3            | 56,160.00           |
| Total.....                |                      |                    |              |                 | 1,495,318.52        |

| Name of levee.            | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.                  | Required to complete. |
|---------------------------|---------------------|-----------------------|-----------------------|------------------------|-----------------------|
|                           | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |                        | <i>Cubic yards.</i>   |
| Arlington.....            | 68,532.50           | 95,680.04             | 13.00                 | \$12,438.40            |                       |
| Shannon.....              | 182,713.59          | 182,713.59            | 13.27                 | <sup>1</sup> 24,252.24 | 2,810.00              |
| Ben Hur.....              | 143,900.00          | 143,900.00            | 8.39                  | <sup>1</sup> 12,073.21 |                       |
| Ben Hur to Burtville..... | 9,928.00            | 9,928.00              | 6.13                  | <sup>1</sup> 609.00    | 365,072.00            |
| Towles.....               |                     |                       | 12.70                 |                        | 408,164.66            |
| Southwood.....            | 56,150.00           | 56,150.00             | 14.12                 | <sup>1</sup> 8,096.88  |                       |
| Total.....                | 461,224.09          | 488,371.63            |                       | 57,469.73              | 776,046.66            |

<sup>1</sup> Field cost by hired labor.

| Machine and location.                | Mobilization. | Clearing. | Plowing. | Operation.  | Repairs.   | Dressing.  | Sodding. |
|--------------------------------------|---------------|-----------|----------|-------------|------------|------------|----------|
| Beauregard, Shannon.....             | \$5,893.52    | \$108.00  | \$243.00 | \$11,890.99 | \$4,529.28 | \$1,492.95 | \$94.5   |
| Buras:                               |               |           |          |             |            |            |          |
| Ben Hur.....                         | 1,068.09      | 15.00     | 330.00   | 14,427.61   | 1,442.19   | 1,907.60   | 132.0    |
| Ben Hur to Burtville.....            |               |           | 30.00    | 424.00      | 100.00     | 45.00      | 10.0     |
| Buras and Beauregard, Southwood..... | 1,410.86      |           | 142.50   | 4,881.39    | 1,144.13   | 464.50     | 53.5     |

| Machine and location.               | Surveys. | Depreciation. | Overhead.  | Total cost. | Yards handled. | Cost per yard. |
|-------------------------------------|----------|---------------|------------|-------------|----------------|----------------|
| Beauregard, Shannon.....            | \$17.50  | \$5,254.44    | \$3,288.83 | \$32,813.01 | 182,713.59     | Cents.<br>17.9 |
| Buras:                              |          |               |            |             |                |                |
| Ben Hur.....                        | 12.00    | 3,681.81      | 2,590.20   | 25,606.50   | 143,900.00     | 17.7           |
| Ben Hur to Burtville.....           | 2.50     | 125.60        | 178.71     | 915.81      | 9,928.00       | 9.2            |
| Buras and Beauregard, Southwood.... | 16.00    | 4,454.19      | 1,010.70   | 13,577.77   | 56,150.00      | 24.1           |

Work was done by contract and by hired labor. Work on the various levees was commenced and finished as follows:

| Name of levee.            | Miles below Cairo. | Work commenced. | Work finished.      |
|---------------------------|--------------------|-----------------|---------------------|
| Arlington.....            | 837 L.             | May 4, 1915     | Dec. 7, 1916        |
| Shannon.....              | 838 L.             | Nov. 15, 1916   | Mar. 8, 1917        |
| Ben Hur.....              | 845 L.             | Sept. 9, 1915   | Mar. 15, 1917       |
| Ben Hur to Burtville..... | 845-7L.            | Mar. 16, 1917   | Under construction. |
| Towles.....               | 850-3L.            |                 | Not commenced.      |
| Southwood.....            | 876 L.             | Apr. 14, 1917   | May 25, 1917        |

The total work done by the United States and local authorities is as follows:

|                                        |                  |         |
|----------------------------------------|------------------|---------|
| Constructed by the United States ..... | cubic yards..... | 461,224 |
| Constructed by local authorities ..... | do.....          | 443,361 |

|                                                    |         |         |
|----------------------------------------------------|---------|---------|
| Total constructed during the year.....             | do..... | 904,585 |
| Percentage of work done by the United States ..... |         | 51      |

The result of the work has been to give increased protection against floods. The completed levee line is 7.56 miles in length.

*Condition at end of present year.*—The following is the condition of the levees at the end of the present year (May 31, 1917):

|                                                                                                                                        |                         |                        |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------|
| Project for earthwork.....                                                                                                             | per cent completed..... | (3)                    |
| Miles in system.....                                                                                                                   |                         | 125.33                 |
| Miles built.....                                                                                                                       |                         | 125.33                 |
| Yardage lost during the year.....                                                                                                      | cubic yards.....        | 167,785                |
| Contents of levees (May 31, 1916).....                                                                                                 | do.....                 | 22,425,506             |
| Required to bring levees to grade and section.....                                                                                     | do.....                 | <sup>2</sup> 9,743,658 |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years..... | cubic yards.....        | 10,560,000             |
| Miles of levee above highest water:                                                                                                    |                         |                        |
| Less than 1 foot.....                                                                                                                  |                         | None.                  |
| From 1 to 2 feet.....                                                                                                                  |                         | 16.27                  |
| From 2 to 3 feet.....                                                                                                                  |                         | 61.87                  |
| From 3 to 4 feet.....                                                                                                                  |                         | 20.39                  |
| From 4 to 5 feet.....                                                                                                                  |                         | None.                  |
| Miles of levee up to full grade, but deficient in section.....                                                                         |                         | 19.24                  |
| Miles of levee up to full grade and section.....                                                                                       |                         | 7.56                   |

<sup>1</sup> Does not include 68,700 cubic yards placed in the new Sarpy levee, as the old levee is still the controlling levee line.

<sup>2</sup> Does not include 408,164 cubic yards under contract.

*Local cooperation.*—Local authorities have expended, in part and between 1882 and January 1, 1917, \$4,476,571.58 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered.

*Proposed operations.*—The project is 31 per cent uncompleted. The work proposed for the next year consists of completing the work now in progress and extending this work as far downstream as funds will permit. The object of this work is to secure the head of the district.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded and any delay may cause serious damage.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                       |                |
|---------------------------------------|----------------|
| New work                              | \$2,061,996.24 |
| Maintenance                           | 171,010.56     |
| Total expended                        | 2,232,006.80   |
| Total appropriations to June 30, 1917 | 2,329,129.61   |

| Fiscal year ending June 30. | 1913        | 1914         | 1915        | 1916        | 1917        |
|-----------------------------|-------------|--------------|-------------|-------------|-------------|
| Expended for new work       | \$49,841.51 | \$102,384.34 | \$54,677.25 | \$38,815.07 |             |
| Expended for maintenance    | 39,703.18   | 616.33       |             | 14,461.00   | \$87,272.88 |
| Total expended              | 89,544.69   | 103,000.67   | 54,677.25   | 53,276.07   | 87,272.88   |
| Appropriated or allotted    | 90,000.00   | 100,000.00   | 45,000.00   | 125,000.00  |             |

|                                                                    |             |
|--------------------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended                                   | \$58,395.69 |
| Amount appropriated by river and harbor act approved July 27, 1916 | 125,000.00  |
|                                                                    | 183,395.69  |

|                                                                                                   |           |
|---------------------------------------------------------------------------------------------------|-----------|
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for new work | 87,272.88 |
|---------------------------------------------------------------------------------------------------|-----------|

|                                                                      |            |
|----------------------------------------------------------------------|------------|
| July 1, 1917, balance unexpended                                     | 96,122.81  |
| July 1, 1917, outstanding liabilities                                | \$3,708.13 |
| July 1, 1917, amount covered by uncompleted contracts                | 60,821.00  |
|                                                                      | 64,529.13  |
| July 1, 1917, balance available for fiscal year ending June 30, 1918 | 31,593.78  |

*Abstract of appropriations.*

| Act of Congress.                                   | Allotted.    | Amount.     |
|----------------------------------------------------|--------------|-------------|
| "BONNET CARRE CREVASSE."                           |              |             |
| Aug. 2, 1882 (river and harbor)                    |              | \$15,000.00 |
| "LEVEES, LEFT BANK BELOW RED RIVER."               |              |             |
| Sept. 19, 1890 (river and harbor)                  | Dec. 4, 1890 | 89,775.00   |
| Do.                                                |              | 21,850.00   |
| Do.                                                |              | 6,750.70    |
| Do.                                                |              | 780.90      |
|                                                    |              | 119,156.60  |
| "PROTECTION OF LEVEES, LEFT BANK BELOW RED RIVER." |              |             |
| Sept. 19, 1890 (river and harbor)                  |              | 6,563.00    |
| Do.                                                | (1)          | 355.30      |
| Do.                                                | (1)          | 41.10       |
| Do.                                                | (1)          | 3,000.00    |
|                                                    |              | 9,959.40    |

<sup>1</sup> By transfer.

## Abstract of appropriations—Continued.

| Act of Congress.                         | Allotted.        | Amount.               |
|------------------------------------------|------------------|-----------------------|
| "PROTECTION OF LEVEES, FOURTH DISTRICT." |                  |                       |
| Aug. 11, 1888 (river and harbor).....    |                  | \$15,630.             |
| "PONTCHARTRAIN LEVEE DISTRICT."          |                  |                       |
| July 13, 1892 (river and harbor).....    | Aug. 10, 1892    | 150,000.              |
| Mar. 3, 1893 (sundry civil).....         | May 18, 1893     | 150,000.              |
| Aug. 18, 1894 (sundry civil).....        |                  | 150,000.              |
| Do.....                                  | ( <sup>1</sup> ) | 4,633.                |
| Mar. 2, 1895 (sundry civil).....         |                  | <sup>2</sup> 147,000. |
| June 3, 1896 (river and harbor).....     | June .., 1896    | 22,500.               |
| June 4, 1897 (sundry civil).....         | Aug. 20, 1897    | 113,150.              |
| July 19, 1897 (deficiency).....          | July 19, 1897    | 22,500.               |
| July 1, 1898 (sundry civil).....         | Mar. 10, 1898    | 60,000.               |
| Do.....                                  | June 29, 1899    | 16,000.               |
| Mar. 3, 1899 (sundry civil).....         | Mar. 13, 1899    | 74,100.               |
| June 6, 1900 (sundry civil).....         | July 20, 1900    | 50,000.               |
| June 13, 1902 (river and harbor).....    | July 12, 1902    | 101,500.              |
| Mar. 3, 1903 (sundry civil).....         | Nov. 25, 1903    | 81,500.               |
| Apr. 28, 1904 (sundry civil).....        | June 25, 1903    | 90,000.               |
| Mar. 3, 1905 (sundry civil).....         | Apr. 26, 1905    | 90,000.               |
| Mar. 3, 1905 (river and harbor).....     | July 29, 1905    | 60,000.               |
| June 30, 1906 (sundry civil).....        | June 28, 1906    | 35,000.               |
| Mar. 2, 1907 (river and harbor).....     | Mar. 27, 1907    | 120,000.              |
| May 27, 1908 (sundry civil).....         | May 4, 1908      | 75,000.               |
| Mar. 4, 1909 (sundry civil).....         | Apr. 28, 1909    | 40,000.               |
| June 25, 1910 (sundry civil).....        | Apr. 30, 1910    | 27,000.               |
| June 25, 1910 (river and harbor).....    | July 6, 1910     | <sup>3</sup> 2,500.   |
| July 25, 1912 (river and harbor).....    | Aug. 3, 1912     | 127,000.              |
| Mar. 4, 1913 (river and harbor).....     | Apr. 30, 1913    | 90,000.               |
| Oct. 2, 1914 (river and harbor).....     | Oct. 15, 1914    | 100,000.              |
| Mar. 4, 1915 (river and harbor).....     | Apr. 18, 1915    | <sup>4</sup> 45,000.  |
| July 27, 1916 (river and harbor).....    | Aug. 14, 1916    | 125,000.              |
|                                          |                  | 2,169,383.            |
| Grand total.....                         |                  | 2,329,129.            |

<sup>1</sup> By transfer.<sup>2</sup> Original allotment, \$150,000; \$3,000 transferred to Atchafalaya levee district.<sup>3</sup> Original allotment, \$23,000; \$8,500 transferred to Barataria levee district, and \$12,000 transferred to Lower Tensas levee district.<sup>4</sup> Original allotment, \$50,000; \$5,000 transferred to harbors at Natchez and Vidalia, Miss. and La.

## Contracts in force.

| Name of contractor.  | Amount of work. | Character of work    | Unit price.  | Date of approval | Date of beginning work. | Date of expiration. | Name of levee. | Miles below Cairo. |
|----------------------|-----------------|----------------------|--------------|------------------|-------------------------|---------------------|----------------|--------------------|
| Don B. Hearin & Son. | 408,164.66      | New and enlargement. | Cents. 12.70 | 1916.<br>Dec. 13 | 1916.<br>Oct. 30        | 1918.<br>Jan. 31    | Towles..       | 850-31             |

## (g) Lake Borgne levee district.

**Location.**—The Lake Borgne levee district extends on the left bank from the lower limits of New Orleans, 973 miles below Cairo, to the Head of the Passes, 1,064 miles below Cairo, with a river frontage of 91 miles. The levee line is continuous to a point about 14 miles above the Head of the Passes, a length of 79.29 miles. The Lake Borgne and Pontchartrain levee districts comprise the same basin, which has a total area of 1,816 square miles.

**Original condition.**—Originally, there were no levees and the country was subject to overflow. The first levees were built by riparian owners under Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

**Previous projects.**—None.

*Present project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, land slope one on three to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results prior to the fiscal year.*—Under the present project work has consisted in building new levees, enlarging and repairing existing levees, and protecting levees during floods. The work has been successful in protecting the basin against overflow from ordinary floods. Protection against extreme floods has not been provided, as the levees have not been completed. As work has progressed on the project, a constantly increasing amount of protection has been afforded by the levees. The exact date when the levee line was closed is not known. Crevasses have occurred as follows:

|      |    |
|------|----|
| 1882 | 29 |
| 1890 | 24 |
| 1892 | 22 |
| 1893 | 3  |
| 1903 | 6  |
| 1907 | 4  |
| 1912 | 1  |

The six breaks which occurred in 1903 were all promptly closed before serious damage had been done. The four breaks in 1907 were minor. The one break in 1912 was immediately closed. During the storm of September 29, 1915, 23 breaks occurred in the levee line. All of these breaks have since been closed. Except as noted above, the uncompleted levee system has protected the basin from floods. The amounts spent for new work and maintenance prior to the beginning of the present fiscal year are \$563,425.62 and \$109,158.52, respectively, a total of \$672,584.14.

*Operations and results during the present year.*—Construction was continued by contract and by hired labor. The work under construction and the progress thereon is shown in the following table and has increased protection against floods.

| Name of levee.    | Kind of work.       | Miles below Cairo. | Length.      | Average height. | In contract.      |
|-------------------|---------------------|--------------------|--------------|-----------------|-------------------|
|                   |                     |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cu. yards.</i> |
| Behair            | New and enlargement | 999 L.             | 5,263        | 12.0            | 51,952.49         |
| Burbridge         | do.                 | 1,000-02 L.        | 11,316       | 8.3             | 49,294.00         |
| Pointe-a-la-Hache | do.                 | 1,015 L.           | 6,435        | 8.5             | 49,713.26         |
| Fort St. Philip   | do.                 | 1,041-2 L.         | 5,383        | 5.8             | 20,000.00         |
| Total             |                     |                    |              |                 | 170,959.75        |

| Name of levee.    | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.      | Required to complete. |
|-------------------|---------------------|-----------------------|-----------------------|------------|-----------------------|
|                   | <i>Cu. yards.</i>   | <i>Cu. yards.</i>     | <i>Cents.</i>         |            | <i>Cu. yards.</i>     |
| Behair            | 51,952.49           | 51,952.49             | 13.64                 | \$7,088.72 |                       |
| Burbridge         | 33,069.00           | 33,069.00             | 13.49                 | 4,459.89   | 16,225                |
| Pointe-a-la-Hache | 5,160.51            | 5,160.51              | 16.3                  | 841.16     |                       |
| Fort St. Philip   | 11,200.00           | 11,200.00             | 11.41                 | 1,278.39   | 8,800                 |
| Total             | 101,382.00          | 101,382.00            |                       | 13,668.16  | 25,025                |

<sup>1</sup> Field cost by hired labor.

The following repairs were made by hired labor at Sophie Levee (1,004 L.): 120,800 square yards of concrete revetment at a cost of \$2,104.70; 1,000 linear feet of wooden revetment at a cost of \$42.60.

| Machine and location. | Mobilization. | Clearing. | Plowing. | Operation. | Repairs. | Dressing. | Sodding. |
|-----------------------|---------------|-----------|----------|------------|----------|-----------|----------|
| Barataria:            |               |           |          |            |          |           |          |
| Belair.....           | \$457.42      | \$293.20  | \$72.00  | \$5,208.61 | \$561.20 | \$306.10  | \$122.   |
| Burbridge.....        | 327.00        | 961.39    | 42.70    | 2,119.32   | 266.81   | 623.10    | 88.      |
| Fort St. Philip.....  | 280.00        | 12.20     |          | 911.99     |          | 68.60     |          |

| Machine and location. | Surveys. | Depreciation. | Overhead.  | Total cost. | Yards handled. | Cost per yard. |
|-----------------------|----------|---------------|------------|-------------|----------------|----------------|
| Barataria:            |          |               |            |             |                |                |
| Belair.....           | \$68.19  | \$1,976.25    | \$1,194.85 | \$10,259.82 | 51,952.49      | Cent 19.       |
| Burbridge.....        | 31.07    | 1,368.12      | 759.30     | 6,587.31    | 33,069.00      | 19.            |
| Fort St. Philip.....  | 5.60     | 339.08        | 257.60     | 1,875.07    | 11,200.00      | 16.            |

Work was done by contract and by hired labor. Work on the various levee was commenced and finished as follows:

| Name of levee.         | Miles below Cairo. | Work commenced. | Work finished.      |
|------------------------|--------------------|-----------------|---------------------|
| Belair.....            | 999 L.             | Oct. 25, 1916   | Dec. 11, 1916.      |
| Burbridge.....         | 1,000-2 L.         | June 15, 1916   | Under construction. |
| Pointe-a-la-Hache..... | 1,015 L.           | Oct. 25, 1915   | Dec. 14, 1916.      |
| Fort St. Philip.....   | 1,041 L.           | May 18, 1917    | Under construction. |

The total work done by the United States and local authorities is as follows:

Constructed by the United States.....cubic yards... 101, 38  
 Constructed by local authorities.....do..... 167, 75

Total constructed during the year.....do..... 269, 13

Percentage of work done by the United States..... 37.6

The result of the work has been to give increased protection against floods. The completed levee line is 43.40 miles in length.

*Condition at end of present year.*—The following is the condition of the levee at the end of the present year (May 31, 1917):

Project for earthwork.....per cent completed... 87.  
 Miles in system..... 78.2  
 Miles built..... 78.2  
 Yardage lost during the year by abandoning old levees.....cubic yards... 95, 30  
 Contents of levees (May 31, 1917).....do..... 5, 600, 17  
 Required to bring levees to grade and section.....do..... 792, 58  
 Required to bring to grade and section and to construct new levees, which will become necessary within the next five years.....cubic yards... 1, 023, 00  
 Miles of levee above highest water:  
 Less than 1 foot..... 0.7  
 From 1 to 2 feet..... 11.6  
 From 2 to 3 feet..... 16.4  
 From 3 to 4 feet..... 2.9  
 Miles of levee up to full grade but deficient in section..... 3.0  
 Miles of levee up to full grade and section..... 43.4

*Local cooperation.*—Local authorities have expended, in part and between 1882 and January 1, 1917, \$1,867,964.58 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto are known to have been made, but no accurate record of them has been discovered.

*Proposed operations.*—The project is 12.4 per cent uncompleted. The work proposed for the next year consists of completing the work now in progress and extending the completed levee line as far as funds will permit. The object of this work is to give greater security to the line.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded and any delay may cause serious damage.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                                             |              |
|---------------------------------------------|--------------|
| For new work .....                          | \$672,521.00 |
| Maintenance .....                           | 62,855.14    |
| Total expended .....                        | 735,376.14   |
| Total appropriations to June 30, 1917 ..... | 772,400.00   |

| Fiscal year ending June 30.    | 1913        | 1914        | 1915        | 1916        | 1917        |
|--------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work .....    | \$13,595.59 | \$86,591.66 | \$45,128.80 | \$51,291.74 | \$28,338.48 |
| Expended for maintenance ..... | 25,036.37   | 2,468.77    |             | 8,030.58    |             |
| Total expended .....           | 39,631.96   | 69,060.43   | 45,128.80   | 59,322.32   | 28,338.48   |
| Appropriated or allotted ..... | 50,000.00   | 75,000.00   | 40,000.00   | 50,000.00   |             |

|                                                                          |             |
|--------------------------------------------------------------------------|-------------|
| July 1, 1916, balance unexpended .....                                   | \$15,362.34 |
| Amount appropriated by river and harbor act approved July 27, 1916 ..... | 50,000.00   |
|                                                                          | 65,362.34   |

|                                                                                                       |           |
|-------------------------------------------------------------------------------------------------------|-----------|
| June 30, 1917, amount expended during fiscal year exclusive of receipts from sales for new work ..... | 28,338.48 |
|-------------------------------------------------------------------------------------------------------|-----------|

|                                             |           |
|---------------------------------------------|-----------|
| July 1, 1917, balance unexpended .....      | 37,023.86 |
| July 1, 1917, outstanding liabilities ..... | 2,908.89  |

|                                                                         |           |
|-------------------------------------------------------------------------|-----------|
| July 1, 1917, balance available for fiscal year ending June 30, 1918 .. | 34,114.97 |
|-------------------------------------------------------------------------|-----------|

*Abstract of appropriations.*

| Act of Congress.                       | Allotted.     | Amount.  |
|----------------------------------------|---------------|----------|
| July 13, 1892 (river and harbor) ..... | Aug. 10, 1892 | \$50,000 |
| Mar. 3, 1893 (sundry civil) .....      | May 18, 1893  | 50,000   |
| Aug. 18, 1894 (sundry civil) .....     |               | 50,000   |
| Mar. 2, 1895 (sundry civil) .....      |               | 49,000   |
| June 3, 1896 (river and harbor) .....  | June —, 1896  | 4,500    |
| June 4, 1897 (sundry civil) .....      | Aug. 20, 1897 | 22,200   |
| July 19, 1897 (deficiency) .....       | July 19, 1897 | 4,500    |
| July 1, 1898 (sundry civil) .....      | Mar. 10, 1898 | 16,000   |
| Do. ....                               | June 29, 1898 | 8,000    |
| Mar. 3, 1899 (sundry civil) .....      | Mar. 13, 1899 | 24,700   |
| June 6, 1900 (sundry civil) .....      | July 20, 1900 | 14,500   |
| June 13, 1902 (sundry civil) .....     | July 12, 1902 | 10,000   |
| Do. ....                               | Mar. 4, 1903  | 2,000    |
| Mar. 3, 1903 (sundry civil) .....      | Nov. 25, 1903 | 10,000   |
| Apr. 28, 1904 (sundry civil) .....     | June 25, 1903 | 15,000   |
| Mar. 3, 1905 (sundry civil) .....      | Apr. 26, 1905 | 15,000   |
| Mar. 3, 1905 (river and harbor) .....  | July 29, 1905 | 15,000   |
| June 30, 1906 (sundry civil) .....     | June 28, 1906 | 10,000   |
| Mar. 2, 1907 (river and harbor) .....  | Mar. 27, 1907 | 25,000   |
| May 27, 1908 (sundry civil) .....      | May 4, 1908   | 40,000   |
| Mar. 4, 1909 (sundry civil) .....      | Apr. 28, 1909 | 6,000    |
| June 25, 1910 (sundry civil) .....     | Apr. 30, 1910 | 17,000   |
| June 25, 1910 (river and harbor) ..... | July 6, 1910  | 6,000    |
| Feb. 27, 1911 (river and harbor) ..... | July 8, 1911  | 13,000   |
| July 25, 1912 (river and harbor) ..... | Aug. 3, 1912  | 80,000   |
| Mar. 4, 1913 (river and harbor) .....  | Apr. 30, 1913 | 50,000   |
| Oct. 2, 1914 (river and harbor) .....  | Oct. 15, 1914 | 75,000   |
| Mar. 4, 1915 (river and harbor) .....  | Apr. 18, 1915 | 40,000   |
| July 2, 1916 (river and harbor) .....  | Aug. 14, 1916 | 50,000   |
| Total .....                            |               | 772,400  |

1 Original allotment, \$50,000; \$1,000 transferred to Homochitto levee district.

## III. SURVEYS.

*Location.*—Surveys are made wherever required throughout the limits of the district.

*Original condition.*—Lack of surveys made data for studies of the river incomplete.

*Previous projects.*—None.

*Present project.*—The project adopted by the Mississippi River Commission in 1884 provides for an annual survey, at the lowest river stage, of each locality where work is in progress. In 1888 the project was amplified to include surveys of caving banks wherever important interests are threatened. Except for New Orleans Harbor, surveys of works are included in the cost of the works and reported therein. Special surveys are made, as ordered, from time to time, by the Mississippi River Commission.

*Operations and results prior to the present year.*—Under the existing project surveys have been made annually. The cost of the work has been \$151,996.55.

The work has been successful in ascertaining rates of caving in time to prevent serious damage and in providing maps from which studies of the river may be made and future work planned.

*Operations and results during the present year.*—The usual survey of the Gouldsboro Bend and Third District Reach, New Orleans Harbor, has been made. The caving banks in Oak and Newtown Bends were surveyed to ascertain amount of caving and the consequent danger of a cut-off. The expenditures amounted to \$3,073.29.

*Condition at end of year.*—All required surveys have been made. The constant changing of the banks and bed of the river require that surveys be continued.

*Local cooperation.*—There is no local cooperation in the making of surveys. The maps and records of the chief State engineer of Louisiana are placed at the disposal of the United States whenever information therefrom is desired.

*Proposed operations.*—It is proposed to continue work under the present project, making annual surveys of each improvement, and such other surveys as the necessities of the case may require.

*Effect of improvement.*—The surveys made during past years and the present year furnish valuable data for the study of the river at definite localities and for making plans for improvements at these localities.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                  |             |
|------------------|-------------|
| New work.....    | \$25,201.37 |
| Maintenance..... | 130,117.01  |

|                                            |            |
|--------------------------------------------|------------|
| Total expended.....                        | 155,318.38 |
| Total appropriations to June 30, 1917..... | 163,137.11 |

| Fiscal year ending June 30.   | 1913       | 1914     | 1915     | 1916     | 1917       |
|-------------------------------|------------|----------|----------|----------|------------|
| Expended for new work.....    |            | \$148.68 | \$744.45 | \$741.00 |            |
| Expended for maintenance..... | \$3,535.45 | 3,640.54 | 4,840.06 | 666.19   | \$3,105.00 |
| Total expended.....           | 3,535.45   | 3,789.22 | 5,584.51 | 1,407.19 | 3,105.00   |
| Appropriated or allotted..... | 5,000.00   |          | 8,000.00 | 5,000.00 |            |

|                                                                         |            |
|-------------------------------------------------------------------------|------------|
| July 1, 1916, balance unexpended.....                                   | \$5,923.80 |
| Amount appropriated by river and harbor act approved July 27, 1916..... | 5,000.00   |

10,923.80

|                                                                                                           |          |
|-----------------------------------------------------------------------------------------------------------|----------|
| June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales, for maintenance..... | 3,105.00 |
|-----------------------------------------------------------------------------------------------------------|----------|

|                                            |          |
|--------------------------------------------|----------|
| July 1, 1917, balance unexpended.....      | 7,818.79 |
| July 1, 1917, outstanding liabilities..... | 767.40   |

|                                                                           |          |
|---------------------------------------------------------------------------|----------|
| July 1, 1917, balance available for fiscal year ending June 30, 1918..... | 7,051.39 |
|---------------------------------------------------------------------------|----------|

*Abstract of appropriations.*

| Act of Congress.                                   | Allotted.        | Amount.               |
|----------------------------------------------------|------------------|-----------------------|
| <i>"SURVEY, UNLEVEED FRONT, FOURTH DISTRICT."</i>  |                  |                       |
| Aug. 2, 1882 (river and harbor).....               |                  | \$1,000.00            |
| <i>"SURVEY, CUBBITTS GAP AND VICINITY."</i>        |                  |                       |
| Aug. 2, 1882 (river and harbor).....               |                  | <sup>1</sup> 137.14   |
| <i>"OBSERVATION AT CARROLLTON, LA."</i>            |                  |                       |
| Aug. 2, 1882 (river and harbor).....               |                  | 3,000.00              |
| Mar. 3, 1883 (river and harbor).....               |                  | 1,500.00              |
|                                                    |                  | 4,500.00              |
| <i>"DISCHARGE OBSERVATIONS."</i>                   |                  |                       |
| Aug. 11, 1888 (river and harbor).....              | Oct. 3, 1888     | 9,000.00              |
| <i>"GAUGES."</i>                                   |                  |                       |
| Aug. 11, 1888 (river and harbor).....              | Oct. 3, 1888     | 2,000.00              |
| <i>"SURVEYS, EXAMINATIONS, AND CONTINGENCIES."</i> |                  |                       |
| Aug. 11, 1888 (river and harbor).....              | Dec. 20, 1888    | 1,000.00              |
| Do.....                                            | Mar. 20, 1890    | 3,000.00              |
|                                                    |                  | 4,000.00              |
| <i>"SURVEYS, GAUGES, AND OBSERVATIONS."</i>        |                  |                       |
| Sept. 19, 1890 (river and harbor).....             | Dec. 4, 1890     | 12,000.00             |
| Do.....                                            | ( <sup>2</sup> ) | 1,000.00              |
| July 13, 1892 (river and harbor).....              | Aug. 10, 1892    | 12,000.00             |
| Mar. 3, 1893 (sundry civil).....                   | May 18, 1893     | 12,000.00             |
| Aug. 18, 1894 (sundry civil).....                  | Sept. 8, 1894    | 12,000.00             |
| Mar. 2, 1895 (sundry civil).....                   | Apr. —, 1895     | 10,000.00             |
| June 3, 1896 (river and harbor).....               | Aug. 25, 1897    | 500.00                |
| Mar. 3, 1899 (sundry civil).....                   | Mar. 13, 1899    | 5,000.00              |
| June 6, 1900 (sundry civil).....                   | May 27, 1899     | 5,000.00              |
| Do.....                                            | Nov. 28, 1900    | 1,000.00              |
| June 13, 1902 (river and harbor).....              | July 12, 1902    | 5,000.00              |
| Mar. 3, 1903 (sundry civil).....                   | July 21, 1903    | 6,000.00              |
| Apr. 28, 1904 (sundry civil).....                  | Apr. 1, 1904     | 6,000.00              |
| Mar. 3, 1905 (sundry civil).....                   | Apr. 26, 1905    | 5,000.00              |
| June 30, 1906 (sundry civil).....                  | June 28, 1906    | 5,600.00              |
| Mar. 2, 1907 (river and harbor).....               | July 12, 1907    | 5,000.00              |
| May 27, 1908 (sundry civil).....                   | May 4, 1908      | 5,000.00              |
| Mar. 4, 1909 (sundry civil).....                   | Apr. 28, 1909    | 3,000.00              |
| June 25, 1910 (sundry civil).....                  | Apr. 30, 1910    | 5,000.00              |
| Feb. 27, 1911 (river and harbor).....              | May 3, 1911      | 5,000.00              |
| July 25, 1912 (river and harbor).....              | Aug. 3, 1912     | 5,000.00              |
| Mar. 4, 1913 (river and harbor).....               | Apr. 30, 1913    | 5,000.00              |
| July 4, 1915 (river and harbor).....               | Apr. 18, 1915    | <sup>3</sup> 8,000.00 |
| July 27, 1916 (river and harbor).....              | Aug. 14, 1916    | 5,000.00              |
| Grand total.....                                   |                  | 163,137.14            |

<sup>1</sup> Original allotment, \$400; \$162.86 transferred to New Orleans Harbor.<sup>2</sup> By transfer.<sup>3</sup> By transfer, \$5,000.

## IV. PLANT.

*(a) Riverment plant.*

*Location.*—At New Orleans, La., and at Natchez, Miss., respectively 965 and 90 miles below Cairo.

*Original condition.*—None.

*Previous projects.*—None.

*Present project.*—Adopted in 1894; provides for the construction of such new plant as may be required from time to time and for the repair, maintenance, and care of the plant on hand.

*Operations and results prior to the present year.*—A plant consisting of 105 large pieces, comprising towboats, hydraulic graders, derrick boats, quarter boats, and barges, together with a fully equipped creosoting cylinder, with the necessary storage tanks railroad-switch tracks, a small woodworking shop, etc.,

had been acquired. The expenditures for new plant had been \$744,777.07, and for repair, maintenance, and care, \$564,822.30, a total of \$1,309,599.37.

*Operations and results during the present year.*—At date of the last annual report the floating plant of the district consisted of 105 large pieces, exclusive of docks, lighters, gasoline launches, pontoons, skiffs, etc. During the year 14 standard creosoted barges have been built. Two old barges, No. 16-C and No. 28-C, were condemned. The plant now comprises 117 large pieces.

*Construction.*—A project for the construction of 18 standard barges and a set of floating ways was approved August 21, 1916. At date of this report 14 of the barges have been completed by hired labor at the engineer depot, and material for the remaining 4 is on hand. In addition to the above plant for this district, 2 levee machines, the *Bourbon* and *Bonaparte*, and 1 steel hull for the third Mississippi River district were assembled and erected by hired labor.

*Creosoting plant.*—Operation of the creosoting plant for the year shows the following totals: Lumber treated, 1,043,000 feet b. m.; pounds of oil used, 1,159,200; value of creosote used, \$14,982.66. The plant was operated for 148 days, during which time 75 barges were treated.

*Government switch.*—During the year 172 cars have been received, comprising 93 of lumber, 16 of creosote oil, 13 of coal, 6 of wire nails, 1 of rope, 2 of machinery, 4 of iron, and 37 of earth filling.

*Repairs.*—The existing plant has been repaired and cared for at the United States engineer depot, New Orleans, La., and at Natchez, Miss., details being as follows:

| Designation.    | Work done.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Cost.      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Newton.....     | Renewed: Pittman of propelling engine, castings in furnace and covering on boilers, 6 stanchions on deck. Five ends of boiler tubes and one stay bolt were electrically welded. Main deck was repaired and calked. Canvas on roof and boiler deck was renewed and painted. Stacks were cleaned and painted. Propelling wheel and all screen doors and windows were repaired. Boat inspected August, 1916.                                                                                                                      | \$3,972.75 |
| Plaquemine..... | Renewed: Heaters in boilers, all furnace castings brickwork in furnace, foundation for capstan engine. Boiler scaled. Repairs to bell pulls, electric light plant, roof, propelling wheel, cabin and machinery to make good usual wear and tear. All dark trimmings painted. Boat and boiler inspected June, 1916.                                                                                                                                                                                                             | 1,804.34   |
| Lafourche.....  | Renewed: Lining in jet condenser, fender streak along bow, 6 swinging fenders, 3 stationary fenders, all brickwork and castings in furnace. Boiler scaled. Propelling wheel and screens repaired. Cabin outside cleaned and painted. Kitchen and engine room painted inside. Usual minor repairs to machinery to make good wear and tear. Boat and boiler inspected during May, 1916.                                                                                                                                          | 2,130.30   |
| Tensas.....     | Docked; hull cleaned and tarred. Renewed: One stock and both rudders, 1 bumper, all tubes in boiler, 6 stationary fenders, smokestack, and breeching. Hold cleaned under floor in fireroom. Wheel repaired. Boat painted throughout. Usual minor repairs to machinery to make good fair wear and tear. Boat and boiler inspected 1916.                                                                                                                                                                                         | 2,374.35   |
| Teche.....      | Minor repairs to screens. Boat and boiler inspected May, 1916. Boat painted.                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 574.68     |
| Chalmette.....  | Docked; hull sandblasted and given coat of coal tar, cement, and headlight oil. All compartments of hull cleaned. Boat painted, rudder bumper rebuilt. Minor repairs to pilot house, master's room, propelling wheel, roof, furnace, and machinery to make good wear and tear. Boat and boiler inspected May, 1916.                                                                                                                                                                                                            | 1,166.34   |
| Tickfaw.....    | Docked; hull cleaned and tarred. Renewed: Eighty-five feet of angle iron on bulwarks, foundation under capstan, nosing and waterway on roof awnings on stern, covers on skiffs, canvas on roof, stern bushing, propeller wheel. Repairs to fender streak, stay bolts in boiler. Boiler reovered and 43 staybolts renewed and electrically welded. All compartments of hold cleaned. Stern tube refastened. Other minor repairs to machinery to make good usual wear and tear. Boat and boiler inspected June and August, 1916. | 5,177.40   |
| Morganza.....   | Docked; hull cleaned and tarred. Renewed: Stern bushing and propeller wheel, 17 rivets in sternpost, 7 rivets in rudder. Boiler cleaned and 1 stay rod repaired. Boat painted throughout. All wearing parts of machinery overhauled and usual repairs to make good fair wear and tear. Boat and boiler inspected May, 1916.                                                                                                                                                                                                    | 2,381.14   |
| Marengo.....    | Docked; hull cleaned and tarred. Renewed: Fifty-five feet fender streak, sheathing on deck, stern bearing, and all furnace castings, all tubes in boiler. Repaired: Sills under cabin, stay rods in boiler, skiff, rudders. Ten stay bolts in combustion chamber were repaired and electrically welded and 12 bolts repaired. Boiler scaled. Cabin and hull painted throughout. Other minor repairs to machinery to make good fair wear and tear. Boat and boiler inspected June, 1916.                                        | 3,635.40   |
| Tunica.....     | Docked; stern bushing and propeller wheel renewed. Ten feet of round about seam of boiler electrically welded. Other minor repairs to machinery and cabin to make good fair wear and tear. Boat and boiler inspected May, 1916.                                                                                                                                                                                                                                                                                                | 2,228.30   |

| Designation.     | Work done.                                                                                                                                                                                                                                                                                                                                                                                                                                         | Cost.      |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| anchac.....      | Docked; hull and cabin rebuilt. Stack furnace and breeching renewed. Machinery thoroughly overhauled and boat painted throughout.                                                                                                                                                                                                                                                                                                                  | \$7,970.00 |
| trader No. 1.... | Renewed: Sheathing on deck, sills under cabin, 64 stanchions under deck beams, smokestack, large gate valve in discharge pipe. Cabin painted. Hold and boiler cleaned. All blankets washed. Other minor repairs to machinery to make good fair wear and tear. Inspected June, 1916.                                                                                                                                                                | 2,114.35   |
| trader No. 2.... | Renewed: Twenty-four window lights. Repairs to electric light plant, boiler tubes. Sides and rakes of hull calked. Outside of boat painted. Other minor repairs to make good fair wear and tear.                                                                                                                                                                                                                                                   | 539.46     |
| Neptune.....     | Docked; hull painted and calked. Rudder stock and tube renewed. Graving piece put in stern. Propeller shaft and rudder renewed. Stern repaired and reinforced with iron band.                                                                                                                                                                                                                                                                      | 616.87     |
| estrice.....     | Hull painted and calked. Propeller shaft renewed and other minor repairs to make good wear and tear.                                                                                                                                                                                                                                                                                                                                               | 132.63     |
| errick No. 1.... | Foundations under derrick renewed, sheathing on deck repaired, other minor repairs to make good fair wear and tear.                                                                                                                                                                                                                                                                                                                                | 987.72     |
| errick No. 2.... | Bits on deck renewed, set of bridle rods installed on boom, angle iron placed on spuds; other minor repairs to make good fair wear and tear.                                                                                                                                                                                                                                                                                                       | 322.21     |
| errick No. 3.... | Minor repairs to machinery to make good fair wear and tear.                                                                                                                                                                                                                                                                                                                                                                                        | 5.15       |
| aver No. 1.....  | Minor repairs and alterations to make good fair wear and tear and increase efficiency.                                                                                                                                                                                                                                                                                                                                                             | 155.26     |
| ew Orleans....   | Boat screened throughout. All blankets washed. Renewed: Part of sills under forward end of cabin on upper deck, 60 feet of nosing and waterway, 6 stationary fenders. Repairs to guards on upper deck, ranges, stoves, water pipes, canvas on guards, floor in kitchen. Tool locker enlarged by removing bulkhead in one stateroom. New shelves and benches in tool room. Sleeping quarters for waiters rebuilt and large lamp and oil room added. | 1,239.44   |
| aton Rouge....   | Boat screened throughout. Cabin scrubbed and trimmings painted. All blankets washed, 3 stationary fenders and all lashings on swinging fenders renewed. Repairs to ranges, stoves and water pipes.                                                                                                                                                                                                                                                 | 678.75     |
| ayou Sara.....   | Boat screened throughout. Cabin scrubbed and trimmings painted. Repairs to ranges, stoves, tanks and water pipes.                                                                                                                                                                                                                                                                                                                                  | 665.43     |
| atchez.....      | Front gallery screened. Minor repairs to toilets, filters, ranges, stoves and water pipes.                                                                                                                                                                                                                                                                                                                                                         | 190.35     |
| ayou Goula....   | Front gallery screened, boat cleaned and scrubbed, roof repaired and painted, minor repairs to toilets, ranges, stoves and water pipes.                                                                                                                                                                                                                                                                                                            | 119.65     |
| orras.....       | Boat painted throughout. Canvas on office and dining room floor renewed. Hull calked to water line.                                                                                                                                                                                                                                                                                                                                                | 176.03     |
| ort Hudson....   | Unusual repairs to ranges, stoves, filters and water pipes to make good wear and tear.                                                                                                                                                                                                                                                                                                                                                             | 61.60      |
| reosote plant..  | Suction pipe between circulating pump and river renewed. Furnace rebuilt, coal bins built: 7 cars repaired. All creosote pipes covered with cement. Repairs to cylinder, pumps, coils in tanks, to make good usual wear and tear.                                                                                                                                                                                                                  | 1,742.19   |
| hop.....         | Cracks in boiler repaired by electrical welding. New punch and shear installed. Usual repairs to belts, shafts, pumps, to make good fair wear and tear.                                                                                                                                                                                                                                                                                            | 1,408.18   |
| kiffs.....       | One skiff built: 21 skiffs repaired and painted.                                                                                                                                                                                                                                                                                                                                                                                                   | 266.72     |
| ump boat.....    | Boiler retubed, breeching repaired.                                                                                                                                                                                                                                                                                                                                                                                                                | 216.65     |
| /harf.....       | Area of wharf increased 8,455 square feet.                                                                                                                                                                                                                                                                                                                                                                                                         | 2,209.44   |
| /arehouse.....   | Minor alterations to increase storage space.                                                                                                                                                                                                                                                                                                                                                                                                       | 79.33      |
| .I. pumps.....   | Forty-eight galvanized iron pumps repaired.                                                                                                                                                                                                                                                                                                                                                                                                        | 66.87      |
| amel Dock.....   | Docked; rebuilding is in progress.                                                                                                                                                                                                                                                                                                                                                                                                                 | 477.99     |
| ectional docks.. | All pumps repaired.                                                                                                                                                                                                                                                                                                                                                                                                                                | 57.00      |
| arge No. 14....  | Docked; bottom and sides and rakes calked, sheathing repaired. Ends of all rake planks cut off and a piece of creosoted timber put in. Bolts tightened, hold cleaned, capstan overhauled.                                                                                                                                                                                                                                                          | 375.00     |
| arge No. 15....  | Docked; bottom, sides, and rakes calked; sheathing repaired, bulkheads repaired, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                                                     | 521.00     |
| arge No. 65....  | Docked; bottom, sides, and rakes calked; two graving pieces put in gun-wales, two bottom planks renewed, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                             | 386.00     |
| arge No. 34....  | Docked; bottom, sides, and rakes calked; two graving pieces put in gun-wales, two bottom planks renewed, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                             | 466.00     |
| arge No. 2.....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 94.00      |
| arge No. 16....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 79.00      |
| arge No. 22....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 66.00      |
| arge No. 45....  | Sides and rakes calked, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                                                                                                              | 32.00      |
| arge No. 59....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 139.00     |
| arge No. 66....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 88.00      |
| arge No. 3.....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 378.00     |
| arge No. 6.....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 121.00     |
| arge No. 33....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 152.00     |
| arge No. 35....  | Sides and rakes calked, sheathing renewed, bulkheads repaired, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                                                                       | 80.00      |
| arge No. 36....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 220.00     |
| arge No. 40....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 403.00     |
| arge No. 46....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 147.00     |
| arge No. 26....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 110.00     |
| arge No. 30....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 172.00     |
| arge No. 42....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 115.00     |
| arge No. 53....  | Sides and rakes calked, sheathing repaired, bulkheads repaired, rakes repaired, bolts tightened, hold cleaned, capstan oiled.                                                                                                                                                                                                                                                                                                                      | 242.00     |
| arge No. 55....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 103.00     |
| arge No. 56....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 256.00     |
| arge No. 57....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 207.00     |
| arge No. 60....  |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 126.00     |

| Designation.      | Work done.                                                                                                             | Cost.    |
|-------------------|------------------------------------------------------------------------------------------------------------------------|----------|
| Barge No. 21..... | Sides and rakes calked, sheathing repaired, bolts tightened, hold cleaned, capstan oiled.                              | \$129.00 |
| Barge No. 24..... |                                                                                                                        | 83.00    |
| Barge No. 27..... |                                                                                                                        | 102.00   |
| Barge No. 41..... | Sides and rakes calked, bulkheads repaired, bolts tightened, hold cleaned, capstan oiled.                              | 200.00   |
| Barge No. 23..... |                                                                                                                        | 122.00   |
| Barge No. 25..... |                                                                                                                        | 141.00   |
| Barge No. 39..... | Sheathing renewed, bulkheads repaired.....                                                                             | 129.00   |
| Barge No. 1.....  |                                                                                                                        | 389.00   |
| Barge No. 4.....  |                                                                                                                        | 40.00    |
| Barge No. 5.....  |                                                                                                                        | 35.00    |
| Barge No. 7.....  |                                                                                                                        | 30.00    |
| Barge No. 8.....  |                                                                                                                        | 79.00    |
| Barge No. 37..... |                                                                                                                        | 11.00    |
| Barge No. 43..... |                                                                                                                        | 36.00    |
| Barge No. 47..... |                                                                                                                        | 38.00    |
| Barge No. 48..... | Sheathing repaired, hold cleaned, bolts tightened, capstan oiled.....                                                  | 96.00    |
| Barge No. 54..... |                                                                                                                        | 11.00    |
| Barge No. 58..... |                                                                                                                        | 31.00    |
| Barge No. 63..... |                                                                                                                        | 29.00    |
| Barge No. 64..... |                                                                                                                        | 64.00    |
| Barge No. 9.....  |                                                                                                                        | 64.00    |
| Barge No. 17..... | Sides and rakes calked, sheathing repaired, rakes repaired, bolts tightened, hold cleaned, capstan oiled.              | 342.00   |
| Barge No. 20..... |                                                                                                                        | 118.00   |
| Barge No. 67..... |                                                                                                                        | 5.00     |
| Barge No. 28..... | Ends docked, sides and rakes calked, sheathing repaired, rakes repaired, bolts tightened, hold cleaned, capstan oiled. | 178.00   |
| Barge No. 32..... |                                                                                                                        |          |
| Barge No. 44..... |                                                                                                                        | 107.00   |
| Barge No. 49..... | Painted with red lead, new false floor in hold, sheathing repaired.....                                                | 353.00   |
|                   | Sheathing repaired and lumber treated for future repairs.....                                                          | 683.00   |
| Barge No. 29..... | Rakes and sides calked, sheathing renewed, bulkheads repaired, and lumber treated for future repairs.                  |          |
|                   | Ends docked, sheathing renewed, bulkheads repaired, rakes repaired, hold cleaned, bolts tightened, capstan oiled.      | 251.00   |

In addition to this total charged to the allotment for plant, minor repairs were made in the field to the tugs *Tickfaw*, *Tunica*, and *Marengo*, steamer *La-fourche*, grader No. 1, and grader No. 2. The cost of these repairs was charged to the several works on which the plant was engaged.

*Care of plant.*—Under this head is included such items as fire protection, electric-light service, watchmen, putting out and taking in spars, mooring lines, etc., operating pump boat, cost of two tugs in commission to handle and care for plant, receiving, issuing, and storing property, proportion of general supervision, etc. The total cost was \$10,224.23, averaging about \$95.66 for each large piece of plant. The cost is increased by the fact that the plant is cared for at two widely separated localities—New Orleans, La., and Natchez, Miss.—necessitating a duplication of some of the charges.

Supt. R. H. Bolen was in charge of the engineer depot of the construction, repair, maintenance, and care of plant, under the general direction of Asst. Engineer H. S. Douglas.

The expenditures for the period covered by this report were \$146,838.98, distributed as follows:

|                                        |             |
|----------------------------------------|-------------|
| New plant.....                         | \$68,746.19 |
| Repairs to plant.....                  | 57,218.81   |
| Care of plant.....                     | 10,224.73   |
| Material purchased and unexpended..... | 10,649.25   |
| Total.....                             | 146,838.98  |

*Condition at end of present year.*—A floating plant consisting of 117 large pieces for bank revetment, levee construction, and dredging has been acquired. A fairly complete engineer depot on the river front at New Orleans has been secured. A warehouse, a combined machine, blacksmith, and carpenter shop has been built, and a creosoting plant has been installed. Other equipment necessary for building new plant and repairing that on hand has been acquired. Suitable railroad tracks have been built and connected with the Public Belt Railway system of the city of New Orleans. The general condition of the plant is good. The project is not susceptible of completion, as new plant must be built from time to time and existing plant repaired, maintained, and cared for. The expenditures on existing project have been \$813,523.26 for new work (plant) and \$642,915.09 for maintenance (repairs and care), making a total of \$1,456,438.35.

*Local cooperation.*—None.

*Effect of improvement.*—Acquisition of the necessary plant to prosecute work y day labor.

*Proposed operations.*—To repair, maintain, and care for the existing plant and to construct such new plant as may be required.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included:

|                  |                |
|------------------|----------------|
| New work.....    | \$814, 918. 71 |
| Maintenance..... | 613, 176. 53   |

|                                            |                 |
|--------------------------------------------|-----------------|
| Total expended.....                        | 1, 428, 095. 24 |
| Total appropriations to June 30, 1917..... | 1, 462, 500. 00 |

| Fiscal year ending June 30.   | 1913          | 1914          | 1915          | 1916          | 1917          |
|-------------------------------|---------------|---------------|---------------|---------------|---------------|
| Expended for new work.....    | \$56, 448. 66 | \$44, 058. 02 | \$39, 013. 92 | \$30, 006. 93 | \$80, 141. 64 |
| Expended for maintenance..... | 51, 849. 71   | 8, 908. 76    | 67, 917. 96   | 70, 679. 22   | 61, 006. 40   |
| Total expended.....           | 108, 298. 37  | 52, 966. 78   | 106, 931. 88  | 100, 686. 15  | 141, 148. 04  |
| Appropriated or allotted..... | 87, 000. 00   | 60, 000. 00   | 105, 000. 00  | 160, 000. 00  | .....         |

|                                                                         |               |
|-------------------------------------------------------------------------|---------------|
| July 1, 1916, balance unexpended.....                                   | \$15, 552. 80 |
| Amount appropriated by river and harbor act approved July 27, 1916..... | 160, 000. 00  |

175, 552. 80

June 30, 1917, amount expended during fiscal year, exclusive of receipts from sales:

|                      |               |
|----------------------|---------------|
| For new work.....    | \$80, 141. 64 |
| For maintenance..... | 61, 006. 40   |
|                      | 141, 148. 04  |

|                                            |             |
|--------------------------------------------|-------------|
| July 1, 1917, balance unexpended.....      | 34, 404. 76 |
| July 1, 1917, outstanding liabilities..... | 19, 207. 22 |

|                                                                           |             |
|---------------------------------------------------------------------------|-------------|
| July 1, 1917, balance available for fiscal year ending June 30, 1918..... | 15, 197. 54 |
|---------------------------------------------------------------------------|-------------|

*Abstract of appropriations.*

| Act of Congress.                      | Allotted.     | Amount.     |
|---------------------------------------|---------------|-------------|
| Aug. 18, 1891 (sundry civil).....     | Sept. 8, 1894 | \$10, 000   |
| June 4, 1897 (sundry civil).....      | Aug. 20, 1897 | 20, 000     |
| July 1, 1898 (sundry civil).....      | Mar. 13, 1899 | 5, 556      |
| Mar. 3, 1899 (sundry civil).....      | Mar. 13, 1899 | 64, 444     |
| June 6, 1900 (sundry civil).....      | July 20, 1900 | 25, 000     |
| June 13, 1902 (river and harbor)..... | July 12, 1902 | 111, 000    |
| Mar. 3, 1903 (sundry civil).....      | Apr. 16, 1903 | 22, 000     |
| Do.....                               | July 21, 1903 | 25, 000     |
| Apr. 28, 1904 (sundry civil).....     | Apr. 1, 1904  | 38, 000     |
| Mar. 3, 1905 (sundry civil).....      | Apr. 26, 1905 | 45, 000     |
| June 30, 1906 (sundry civil).....     | June 28, 1906 | 55, 000     |
| Apr. 2, 1907 (river and harbor).....  | Apr. 6, 1907  | 65, 000     |
| May 27, 1908 (sundry civil).....      | May 4, 1908   | 55, 000     |
| Do.....                               | (1)           | 1, 500      |
| Apr. 4, 1909 (sundry civil).....      | Apr. 28, 1909 | 106, 000    |
| June 25, 1910 (sundry civil).....     | Apr. 30, 1910 | 100, 000    |
| June 25, 1910 (river and harbor)..... | July 6, 1910  | 122, 000    |
| Feb. 27, 1911 (river and harbor)..... | May 3, 1911   | 95, 000     |
| July 25, 1912 (river and harbor)..... | Aug. 3, 1912  | 85, 000     |
| Apr. 4, 1913 (river and harbor).....  | Apr. 30, 1913 | 87, 000     |
| Oct. 2, 1914 (river and harbor).....  | Oct. 15, 1914 | 60, 000     |
| Mar. 4, 1915 (river and harbor).....  | Apr. 18, 1915 | 165, 000    |
| July 27, 1916 (river and harbor)..... | Aug. 11, 1916 | 160, 000    |
| Total.....                            |               | 1, 462, 500 |

<sup>1</sup> By transfer.

<sup>2</sup> Original amount allotted, \$100,000; \$5,000 transferred to Kemp Bend reclamation.

*(b) Levee plant.*

No project exists for levee plant. Such plant as is required is purchased from time to time and pertains to all levee districts.

*Operations and results prior to the present year.*—Three levee machines of the revolving locomotive-crane type, one steel hull, two wooden hulls, three quarter-boats, and one plant for levee paving have been built and maintained. The cost for new work was \$142,582.09. The cost of maintenance, which was not absorbed in cost of work accomplished, was \$6,633.15. The result has been to decrease the cost of levee construction, to greatly improve the methods of construction, and to facilitate high-water protection.

*Operations and results during the present year.*—The cost of maintenance has been absorbed in the cost of the work upon which the plant was engaged.

*Condition at end of year.*—All levee plant is in good condition and in successful operation. One levee machine of 72-foot radius was repaired and converted into a machine of 100-foot radius at a cost of \$11,498.46. Another steel barge was added to the plant at a cost of \$21,075.90. The amount of plant is insufficient to realize the greatest economy in levee work. An addition of two locomotive cranes of 125-foot radius and 20-ton capacity, with all attendant plant and 14 creosoted wooden standard barges are needed to give the required economy below Red River. The work of the levee machine is greatly hampered by a shortage of barges, which are needed for transporting coal, gravel, sand, tracks, and supplies.

*Proposed operations.*—None.

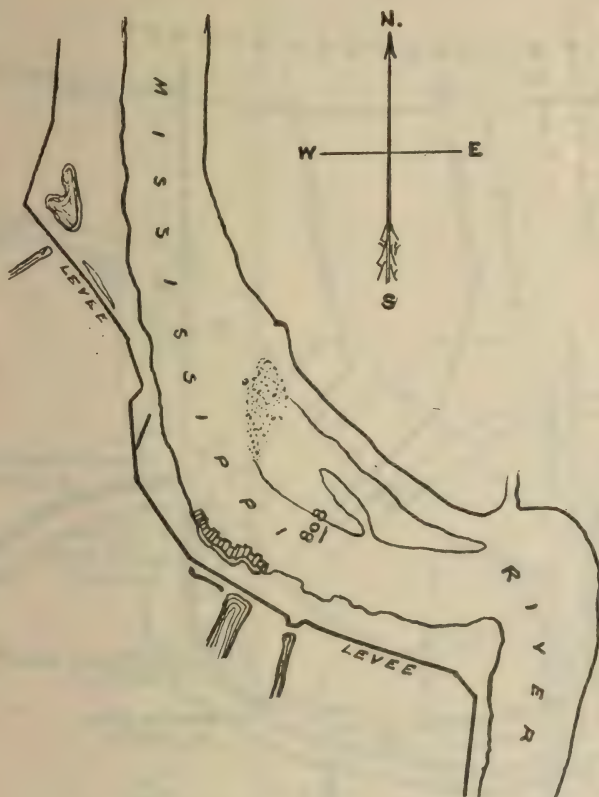
*Effect of improvement.*—The introduction of Government-owned plant has cheapened the cost of levee work, especially below Red River, and added greatly to the safety of the levees during floods and reduced the cost of high-water protection.

The following inclosures (maps) accompany and form part of this report:

1. Hard Times Bend, La.
2. Bondurant Chute, La.
3. Kempe Bend, La.
4. Natchez and Vidalia Harbors, Miss. and La.
5. Grand Bay, La.
6. New Orleans Harbor, La.
7. Levee map, fourth district.
8. Lower Tensas levee district profile.
9. Atchafalaya levee district profile.
10. Lafourche levee district profile.
11. Barataria levee district profile.
12. Pontchartrain levee district profile.
13. Lake Borgne levee district profile.

G. McC. DERBY,  
*Lieutenant Colonel, United States Army, Retired.*

PLATE No 5.



New Orleans, La.

*E. M. C. H. C.*

Lt. Col. U.S. Army.

To Accompany Annual Report 1916-1917.

MISSISSIPPI RIVER COMMISSION  
FOURTH DISTRICT**GRAND BAY.**

CONDITION OF WORK JUNE 30, 1917.

Scale of Miles.

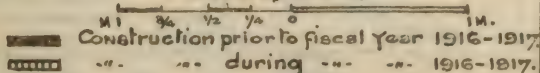
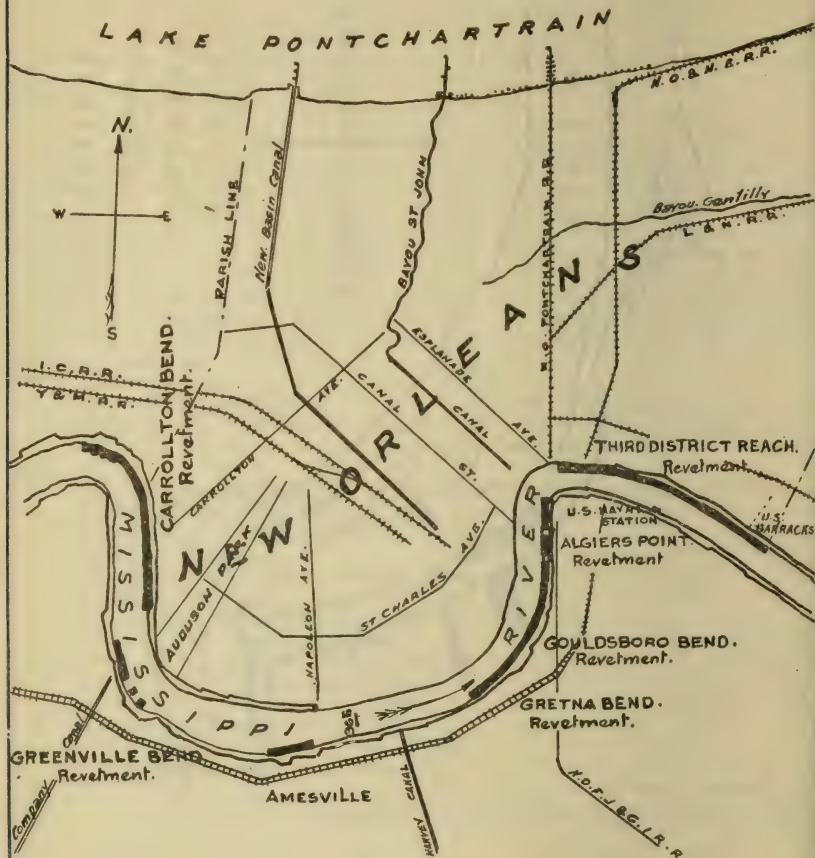


PLATE N<sup>o</sup> 6.



New Orleans, La.

*MacDermott*  
Lt. Col. U.S. Army.

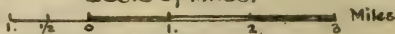
Lt. Col. U.S. Army.

To Accompany Annual Report, 1916-1917.

MISSISSIPPI RIVER COMMISSION  
FOURTH DISTRICT.

NEW ORLEANS HARBOR. LA.

CONDITION OF WORK JUNE 30. 1917.  
Scale of Miles.



Construction prior to fiscal year 1916-1917.  
-u. -u. during -u. -u. 1916-1917.





MISSISSIPPI RIVER COMMISSION  
Fourth District.  
UNDER THE DIRECTION OF  
Lieut. Col. G. M. C. Derby, U.S. Army.  
LEVEES.

Scale of Miles.

Note: ~~new~~ Approx. location of Levees built wholly or in part by the U.S.  
by Local Levee Boards.  
River distances indicate Miles below Cairo.  
Figures along levee line are station numbers of each district.

New Orleans, La.

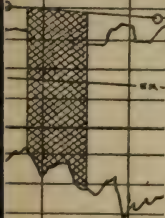
*G. McCord*  
Lieut. Col., U.S. Army.

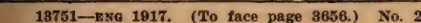
To accompany annual report for Fiscal year ending June 30, 1917.

me

Published Com  
West Water 19  
est -- 19  
es built by  
es enlarged  
es built by  
es enlarged

State New comp. 1946-17.





RIVER COMMISSION.  
TH DISTRICT.  
LAYA LEVEES.

THE DIRECTION OF  
Mc C. Derby, U.S. Army.

loch, Asst. Engineer.

y 688 May 1917.

y 688 May 1917.

Scale of Feet.

10000' 20000' 30000' 40000'

ELIZA.

120 MIs.

MODESTE.

DONALDSONVILLE  
88.2 MIs. below CAIRO.

70'

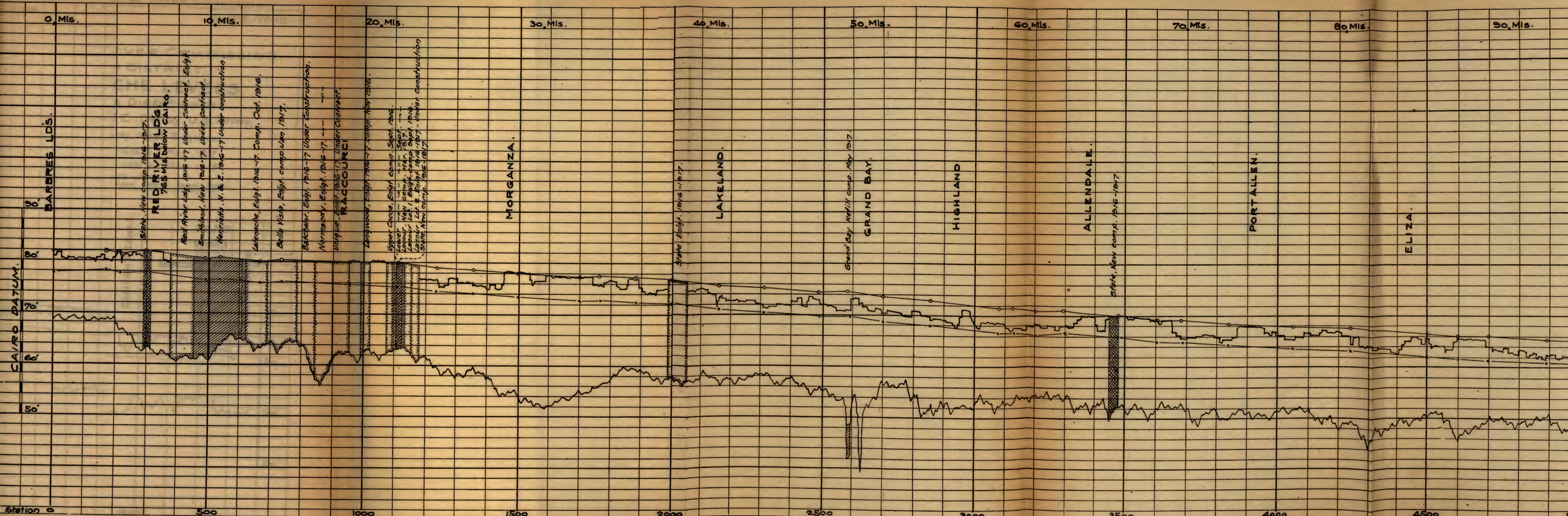
60'

50'

40'

4500

6500



New Orleans, La.  
To accompany Annual Report for  
Fiscal year ending June 30, 1917.

*Emory M. Hall*  
Lieut. Col., U.S. Army

MISSISSIPPI RIVER COMMISSION  
FOURTH DISTRICT.

**ATCHAFALAYA LEVEES.**

UNDER THE DIRECTION OF

Lieut. Col. G. M. C. Derby, U.S. Army.

W. E. Knobloch, Asst. Engineer.

Drawn by *E. J. J.* May 1917.

Traced by *E. J. J.* May 1917.

- Established Commission Grade.
- Highest Water Level 1912.
- Levees built by U.S. 1916-1917.
- Enlarged ---
- Built by Local Authorities 1916-1917.
- Enlarged by ---

Scale of Feet.  
0 10000' 20000' 30000' 40000'

MISSISSIPPI RIVER COMMISSION.

NEW ORLEANS DISTRICT.

THE LEVEES.

THE DIRECTION OF

BY C. C. Derby, U.S. Army.

Asst. Engineer.

May 1917.

May 1917.

Scale of Feet.  
10000 20000 30000 40000

LUCY.

COMPANY CANAL.

80. Mls.

GOULDSBORO.

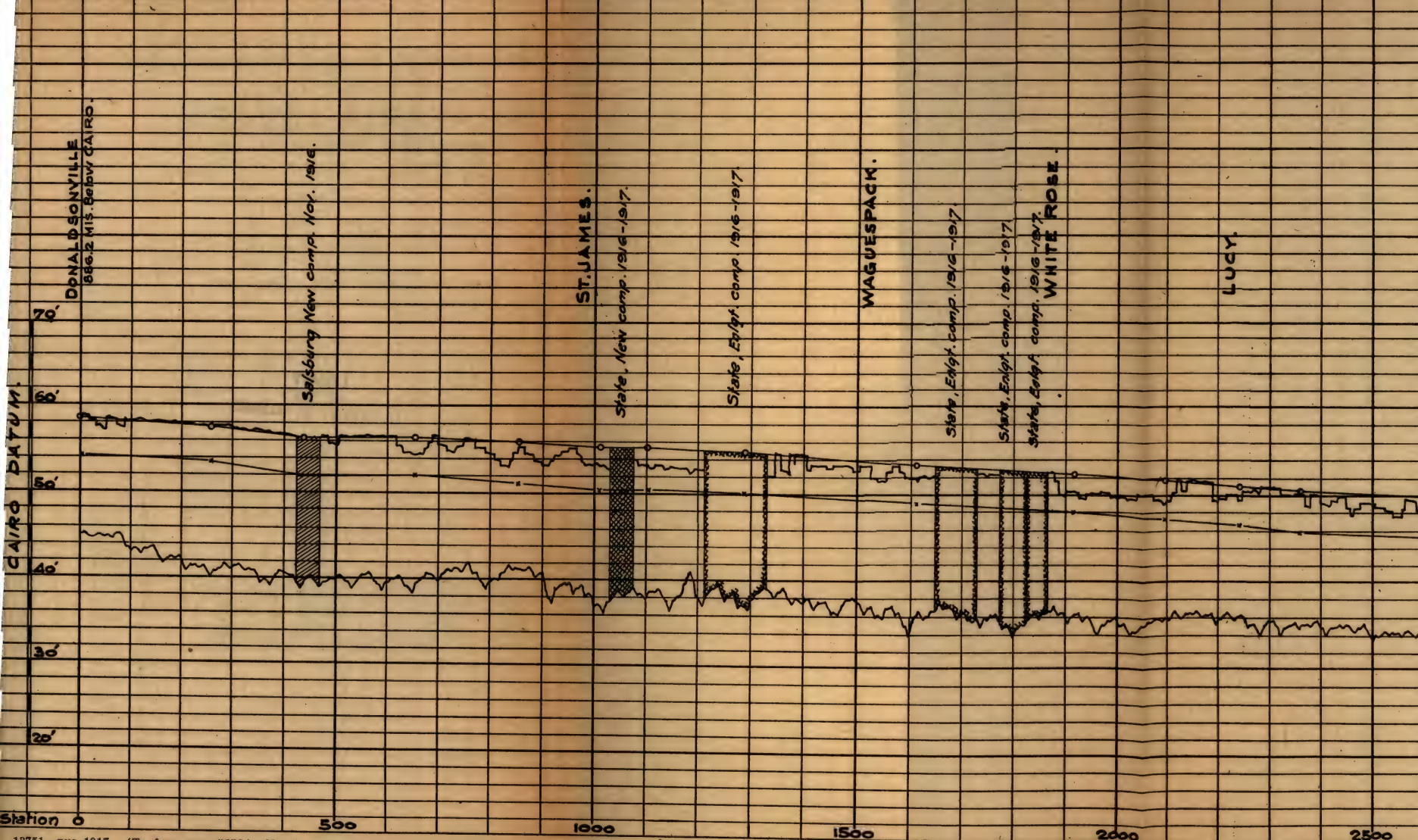
50'

40'

30'

20'

4000



New Orleans, La.  
To accompany Annual Report for  
fiscal year ending June 30, 1917.

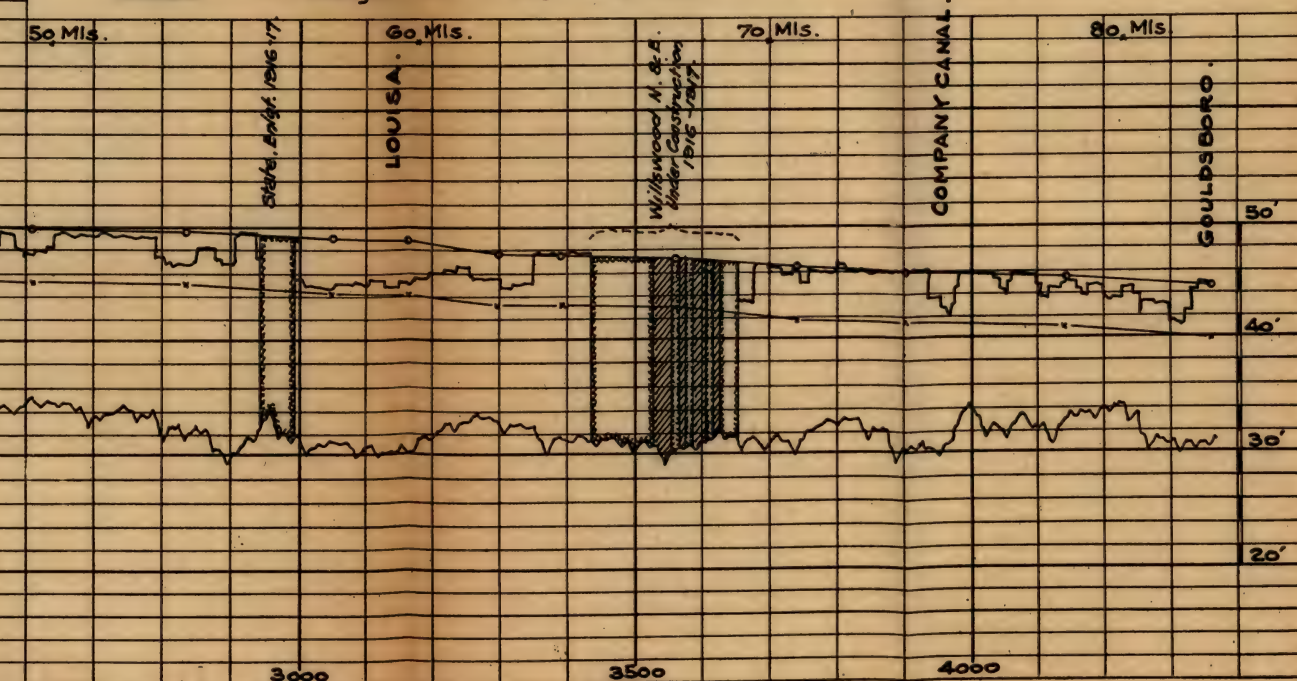
*Frederick*  
Lieut. Col., U.S. Army.

MISSISSIPPI RIVER COMMISSION.  
FOURTH DISTRICT.  
**LAFOURCHE LEVEES.**  
UNDER THE DIRECTION OF  
Lieut. Col. G. M. C. Derby, U.S. Army.  
W. E. Knobloch, Asst. Engineer.

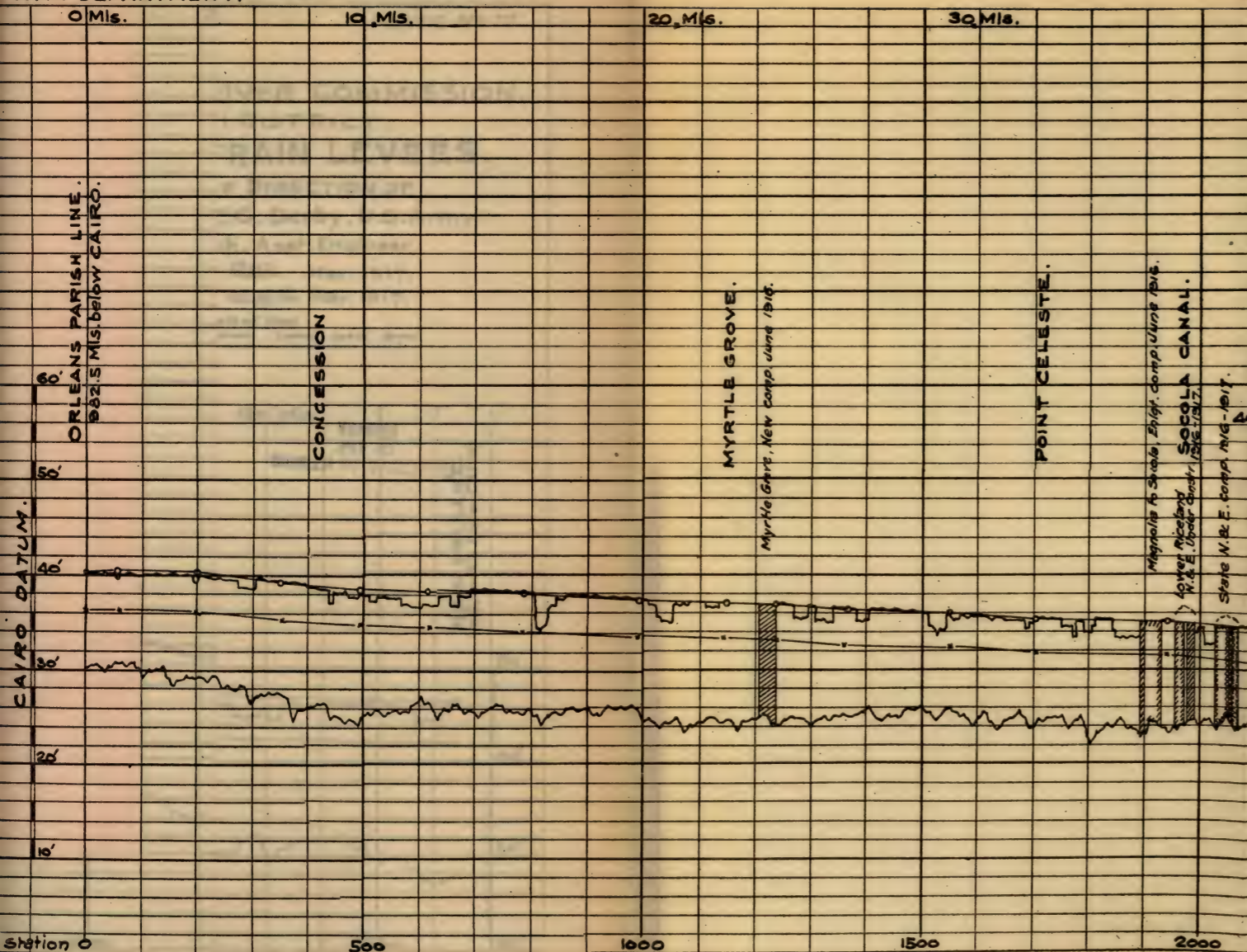
Drawn by *G. E. D.* May 1917.  
Traced by *G. E. D.* May 1917.

- Established Commission Grade.
- Highest Water Level 1912.
- Levees built by U.S. 1916-1917.
- Enlarged.
- Built by Local Authorities 1916-1917.
- Enlarged.

Scale of Feet.  
10000' 0 10000 20000 30000 40000'



1. The first part of the paper is devoted to the study of the properties of the function  $f(x)$  defined by the equation  $f(x) = \int_0^x f(t) dt$ . It is shown that  $f(x)$  is a continuous function and that  $f(0) = 0$ . The second part of the paper is devoted to the study of the properties of the function  $g(x)$  defined by the equation  $g(x) = \int_0^x g(t) dt$ . It is shown that  $g(x)$  is a continuous function and that  $g(0) = 0$ . The third part of the paper is devoted to the study of the properties of the function  $h(x)$  defined by the equation  $h(x) = \int_0^x h(t) dt$ . It is shown that  $h(x)$  is a continuous function and that  $h(0) = 0$ .



New Orleans, La.

To accompany Annual Report for  
fiscal year ending, June 30, 1917.

*G. M. C. Derby*  
Lieut. Col., U.S. Army.

MISSISSIPPI RIVER COMMISSION.  
FOURTH DISTRICT.

## BARATARIA LEVEES.

UNDER THE DIRECTION OF

Lieut. Col. G. M. C. Derby, U.S. Army.

W. E. Knobloch, Asst. Engineer.

Drawn by *W. E. Knobloch* May, 1917Traced by *W. E. Knobloch* May 1917.

Scale of Feet.

10000' 10000' 20000' 30000' 40000'

- Established Commission Grade.
- Highest Water Level 1912.
- Levees built by U. S. 1916-1917.
- Levees enlarged " " " " " "
- Levees built by Local Authorities, 1916-1917.
- Levees enlarged " " " " " "

RIVER COMMISSION.  
DISTRICT.  
RAIN LEVEES.

E DIRECTION OF  
EC. Derby, U.S. Army.  
ch, Asst. Engineer.

*B. B. Q.* May. 1917.

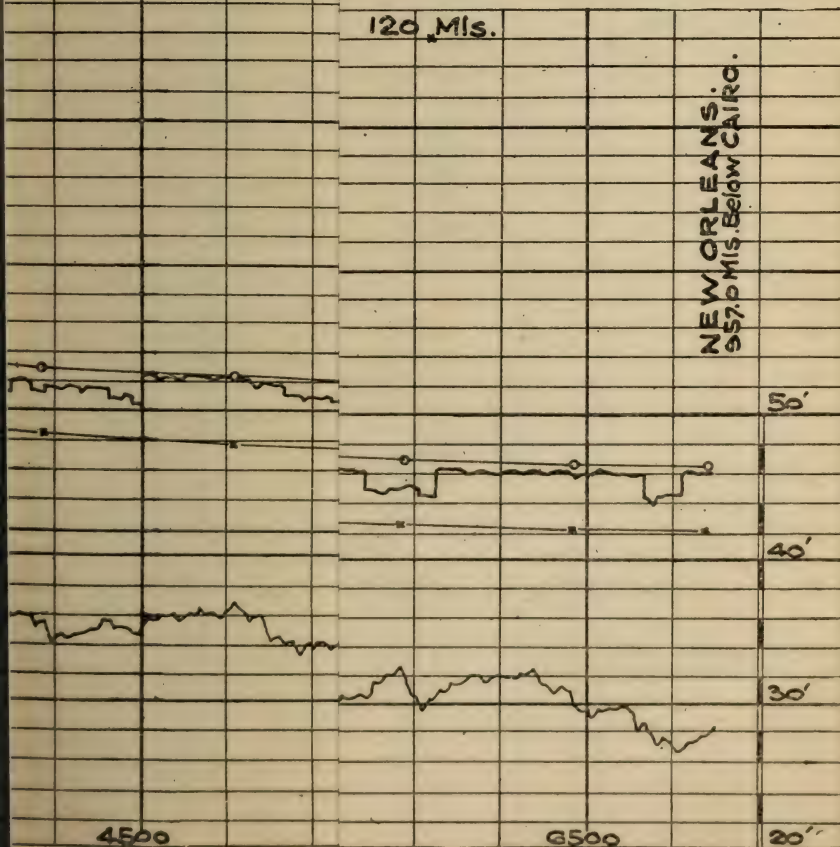
*B. B. Q.* May 1917.

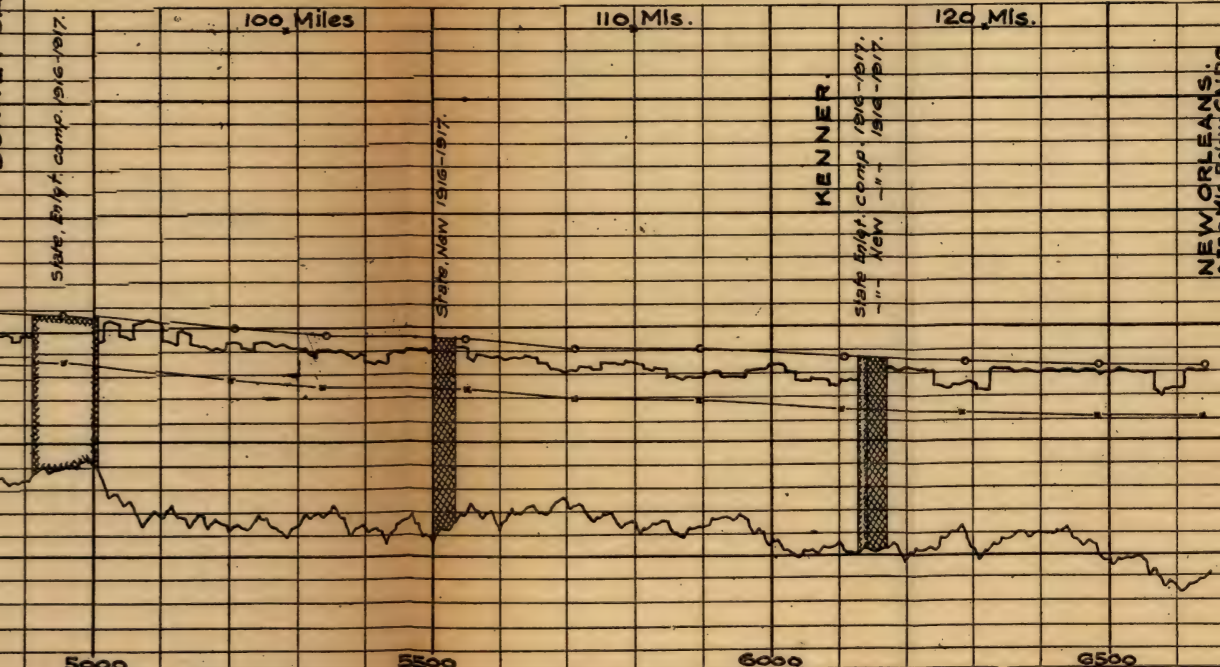
Scale of Feet.

10000' 20000' 30000' 40000'







120 Mls.

NEW ORLEANS.  
55.75 Mls. Below CAIRO.





Drawn by B.E. May. 1917.  
Traced by B.E. May 1917.

 Established Commission Grade.  
 Highest Water Level 1912.  
 Levees built by U.S. 1916-1917.  
 Levees enlarged --" --" --"  
 Levees built by Local Authorities, 1916-1917.  
 Levees enlarged --" --" --" --"

Scale of Feet.

VER COMMISSION

PLATE NO 13

COMMISSION.

RICT.

Te LEVEES.

Fi CTION OF

by, U.S. Army.

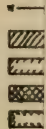
. Engineer.

May 1917.

May 1917.

0' 20000' 40000'

0



50'

State New & Enlgt. comp 1916-1917.  
PT. A LA HACHE.  
Point a la Hache, New & Enlgt. Comp. Dec. 1916.  
State, New & Enlgt. 1916-1917.

State New & Enlgt. comp 1916-1917.

40'

30'

20'

10'

2500

4000

MISSISSIPPI RIVER COMMISSION.

FOURTH DISTRICT.

LAKE BORGNE LEVEES.

UNDER THE DIRECTION OF

Lieut. Col. G. Mc C. Derby, U.S. Army.

W.E. Knobloch, Asst. Engineer.

Drawn by *EBB* May 1917.

Traced by *EBB* May 1917.

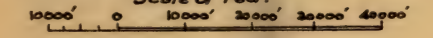
New Orleans, La.

To accompany Annual Report for  
Fiscal year ending June 30, 1917.

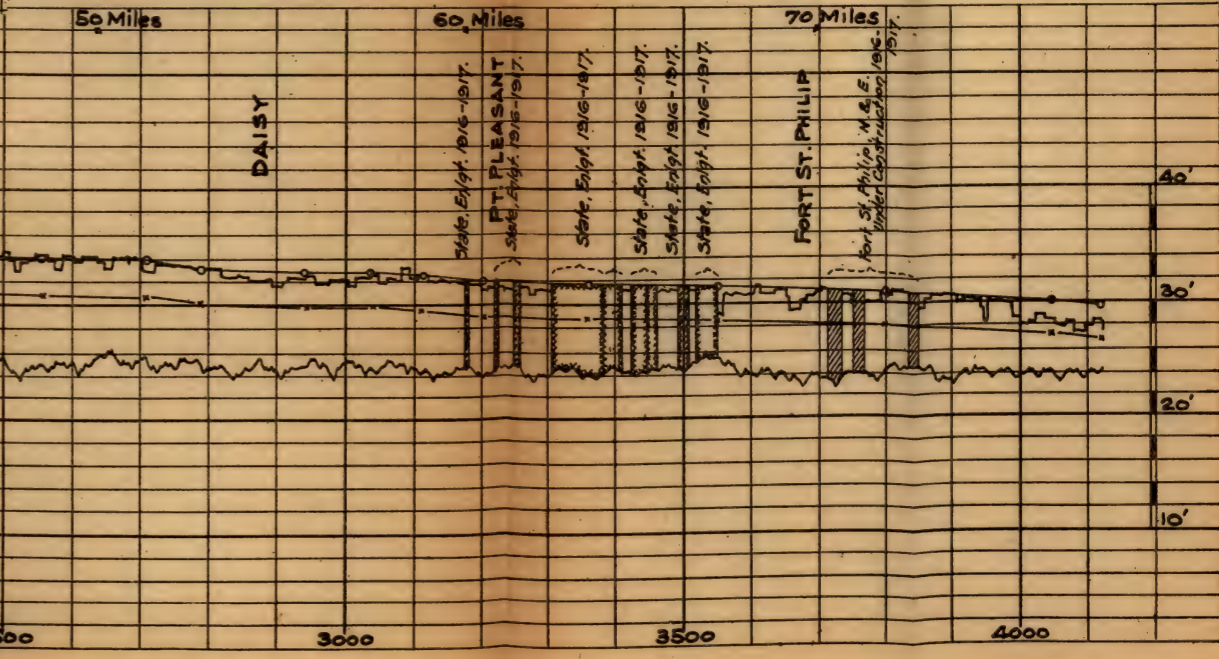
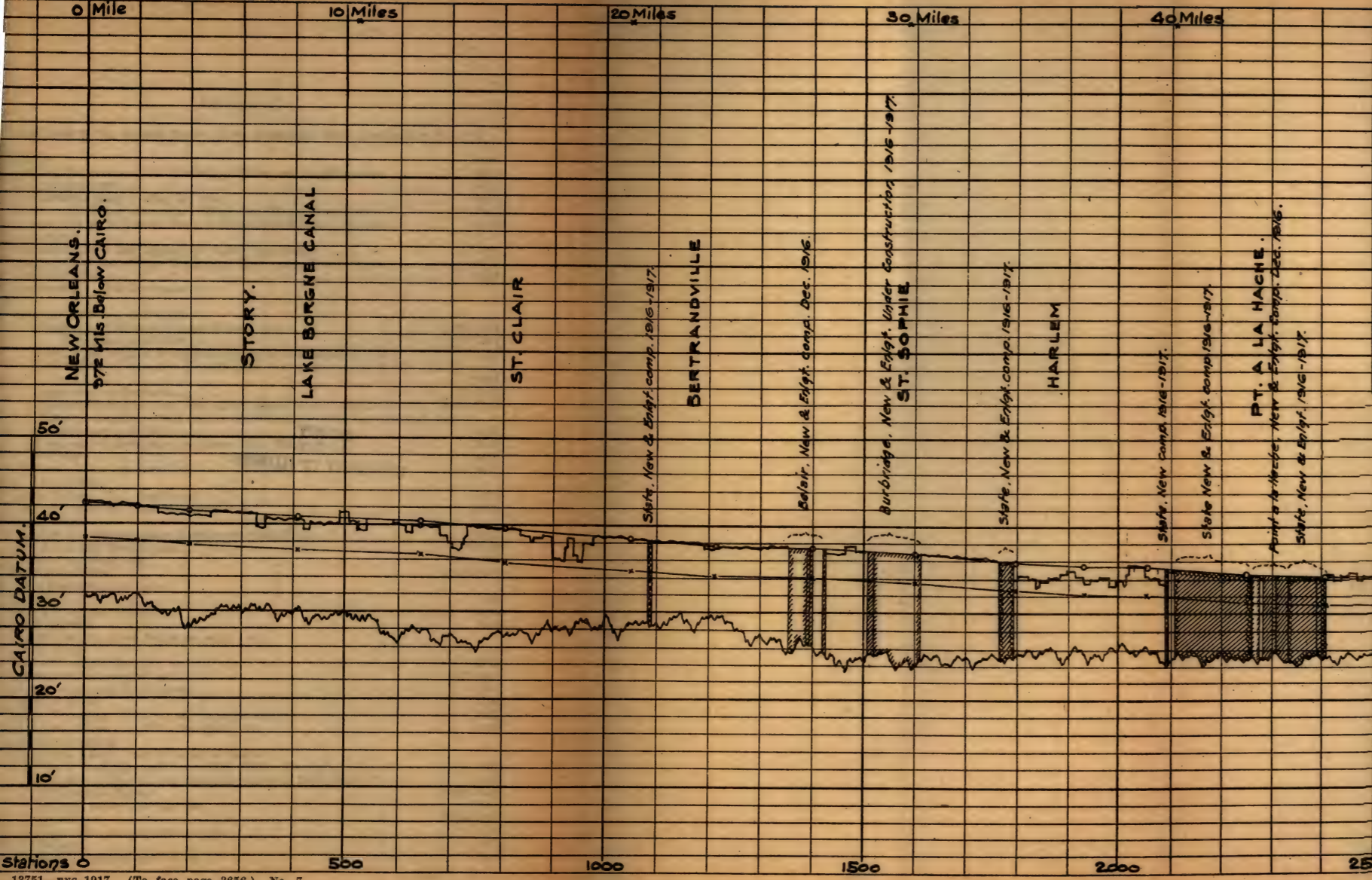
*G. McC. Derby*

Lieut. Col., U.S. Army.

Scale of Feet.



- Established Commission Grade.
- Highest Water Level 1912.
- Levees built by U.S. 1916-1917.
- Levees enlarged -- -- --
- Levees built by Local Authorities, 1916-1917.
- Levees enlarged -- -- --



## APPENDIX 5.

### *Topical index to the Annual Report of the Mississippi River Commission for 1917.*

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>otments:</p> <p>Gauging the waters of the Mississippi River and its tributaries.....</p> <p>Made during year.....</p> <p>Reallotments made during the year.....</p> <p>Titles of, in charge of secretary Mississippi River Commission.....</p> <p>pendixes, list of, to Annual Report Mississippi River Commission.....</p> <p>ropriations:</p> <p>Expended under the Mississippi River Commission.....</p> <p>Gauging the waters of the Mississippi River and its tributaries.....</p> <p>Recommended.....</p> <p>nk protection. (See Revetments.)</p> <p>rs:</p> <p>Mississippi River, below Cairo—</p> <p>Condition of channel at end of fiscal year.....</p> <p>In original condition.....</p> <p>Depths and widths of channel during lowest stages of year.....</p> <p>Dimensions of channels through bars, low-water season of 1916 (Table No. 6).....</p> <p>Inspection of channels.....</p> <p>Names and depths over; low-water season of 1916 (Table No. 5).....</p> <p>Notes on conditions and results of dredging at each bar dredged, low-water season of 1916.....</p> <p>Summary of dredging operations, 1916 (Table No. 7).....</p> <p>Surveys.....</p> <p>Old river channel maintained.....</p> <p>ats. (See Plant.)</p> <p>rings at Helena, Ark., continued.....</p> <p>ildings and grounds, West Memphis, Ark.....</p> <p>arts and maps:</p> <p>Contract for printing maps of resurvey entered into.....</p> <p>Issued and sold during year.....</p> <p>al, amount received, etc.....</p> <p>mmercial statistics.....</p> <p>ntracts, abstract of, in force:</p> <p>Secretary.....</p> <p>First and second districts.....</p> <p>Third district.....</p> <p>Fourth district, given following each work.....</p> <p>osoting plant:</p> <p>First and second districts, repairs, etc.....</p> <p>Fourth district, repairs, etc.....</p> <p>svasses in Arkansas River closed.....</p> <p>m in Wolf River.....</p> <p>harge, Mississippi River and tributaries reported.....</p> <p>cks, marine railway, at West Memphis, Ark.....</p> <p>dges and dredging:</p> <p>Mississippi River, Cairo to Head of Passes—</p> <p>Cost of dredging operations, 1916 (Table No. 4).....</p> <p>Division of time during dredging season of 1916 (Table No. 7).....</p> <p>In Memphis Harbor.....</p> <p>Material moved during year.....</p> <p>Operations.....</p> <p>Plant, etc., in connection with.....</p> <p>Project.....</p> <p>Old River, dredging operations:</p> | <p>Page.</p> <p>3417</p> <p>3416</p> <p>3417</p> <p>3461</p> <p>3461</p> <p>3424</p> <p>3417</p> <p>3423</p> <p></p> <p></p> <p>3419, 3471</p> <p>3463</p> <p>3423</p> <p>3498</p> <p>3464</p> <p>3494-3497</p> <p></p> <p>3467</p> <p>3499</p> <p>3464</p> <p>3613</p> <p></p> <p>3524</p> <p>3470</p> <p></p> <p>3462</p> <p>3483</p> <p>3471</p> <p>3480-3482</p> <p></p> <p>3479</p> <p>3546</p> <p>3590</p> <p></p> <p>3543</p> <p>3652, 3653</p> <p>3582</p> <p>3469</p> <p>3462</p> <p>3470</p> <p></p> <p></p> <p>3492</p> <p>3499</p> <p>3468, 3518</p> <p>3464</p> <p>3464-3468</p> <p>3470</p> <p>3463</p> <p>3613</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                     | Page            |
|---------------------------------------------------------------------------------------------------------------------|-----------------|
| Engineer districts under Mississippi River Commission, limits of and officers in charge:                            |                 |
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ANNUAL REPORT OF THE CHIEF OF ENGINEERS, 1918

EXTRACT

# REPORT OF THE MISSISSIPPI RIVER COMMISSION



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1918

EXTRACT FROM THE ANNUAL REPORT OF THE CHIEF OF ENGINEERS  
TO THE SECRETARY OF WAR.]

WAR DEPARTMENT,  
OFFICE OF THE CHIEF OF ENGINEERS,  
Washington, September 10, 1918.

\* \* \* \* \*

MISSISSIPPI RIVER COMMISSION.

Improvement of Mississippi River in charge of the Mississippi River Commission.

*Commission headquarters.*—St. Louis, Mo.

*Commissioners.*—The commissioners during the fiscal year were Col. J. G. Warren, Corps of Engineers, United States Army, acting president to July 10, 1917; Brig. Gen. W. H. Bixby, United States Army, retired, acting president July 10–18, president from July 18, 1917; J. A. Ockerson, civil engineer; Homer P. Ritter, hydrographer and geodetic engineer, United States Coast and Geodetic Survey; Charles H. West, civil engineer; Col. Lansing H. Beach, Corps of Engineers, United States Army; and Edward A. Glenn.

For convenience in administration and allotment of funds, the river from Rock Island, Ill., to the Head of Passes, a distance of 1,562 miles, is divided into districts and suboffices as follows:

*First district.*—Cape Girardeau, Mo., to foot of Island No. 40, 27 miles, of which Cape Girardeau to Cairo, 54 miles, is restricted to levee work.

*Second district.*—Foot of Island No. 40 to White River, 173 miles. Office, Customhouse, Memphis, Tenn.

*Third district.*—White River to Warrenton, Miss., 214 miles. Office, Postoffice Building, Vicksburg, Miss.

*Fourth district.*—Warrenton to Head of Passes, 453 miles. Office, 519 Canal Street, New Orleans, La.

*Dredging district.*—Dredging operations below Cairo. Office, United States Dredging Fleet, Memphis, Tenn.

273472P  
1917/18  
*Upper Mississippi district.*—Levees Cape Girardeau to Rock Island, 452 miles; and secretary's office, surveys, gages, etc. Office, 311 International Life Building, St. Louis, Mo.

*Jurisdiction of commission.*—The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvements of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya Rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters and with gauging the river and its tributaries. By act of Congress approved March 4, 1913, an appropriation for levees from Cape Girardeau, Mo., to Rock Island, Ill., was made for expenditure under the commission. Acts of Congress approved July 27, 1916, and March 3, 1917, provided for the continuation of levee work from Cape Girardeau, Mo., to Rock Island, Ill., and extended the jurisdiction of the commission to include work on the Ohio River from its mouth to the mouth of the Cache River, and on the Arkansas River from its mouth to its intersection with the division line between Lincoln and Jefferson Counties.

*Location and description.*—The Mississippi River rises at Lake Itasca, Minn. It flows in a general southerly direction and empties into the Gulf of Mexico. The total length of the river is 2,471 miles. The total length of river between Rock Island, Ill., and the Head of Passes is 1,562 miles. This portion of the river receives the drainage from an area of about 1,240,000 square miles, comprising nearly all the United States between the Rocky and Appalachian mountain ranges. Discharge measurements of the river show a maximum of 153,000 second-feet and minimum of 21,000 second-feet at Rock Island, 511 miles above Cairo; a maximum of 1,146,000 second-feet and a minimum of 24,000 second-feet at St. Louis, 190 miles above Cairo; and a maximum of 2,015,000 second-feet and minimum of 71,000 second-feet at Columbus, Ky., 20 miles below Cairo. The ordinary low-water stages prevail through the five months, August to December, inclusive, each year. Extreme high-water stages may occur during any month in the year on the river between Rock Island and Cairo. Extreme high-water stages usually occur in the months, March to June, inclusive, at Cairo; and the crest travels from Cairo to New Orleans, a distance of 960 miles, in about 30 days. Ordinary high-water stages may occur at any season of the year, but are of infrequent occurrence during the summer and fall seasons. The extreme range in stages on record is 20.5 feet at Rock Island, 55.7 feet at Cairo, and 22.6 feet at New Orleans. The river is nontidal above the mouth of Red River, 296 miles from the Head of Passes. The amplitude of the tide at Red River Landing rarely exceeds 0.1 foot during extreme low water.

*Original condition.*—Low-water navigation was rendered difficult and hazardous by the formation of bars across the channel, sometimes limiting the controlling depth to  $4\frac{1}{2}$  feet.

*Previous projects.*—The original project contained in the report of the Mississippi River Commission, dated February 17, 1880, contemplated the permanent fixing and improvement of the channel to

a depth of at least 10 feet at the extreme low water, by the contraction of the low-water width to about 3,000 feet, the protection of the banks against caving, and the control of the flood water by means of levees.

*Existing project.*—The existing project is to maintain a channel not less than 9 feet deep and not less than 250 feet wide from the mouth of the Ohio River to the Head of Passes, near the Gulf of Mexico, a distance of 1,060 miles, by open-channel work and by dredging; to confine the river below Cairo to a permanent position by bank revetment; to maintain a navigable channel between the waters of the Mississippi, Red, and Atchafalaya Rivers; to control flood waters from Rock Island to Head of Passes by levees; and to make such surveys, examinations, and investigations of the Mississippi River and its tributaries as may be deemed necessary for the execution of the project. Specific provisions were made by the river and harbor act of June 3, 1896, for constructing dredging plant and maintaining for low-water navigation below Cairo a channel of 250 feet width and 9 feet depth at all periods of the year, except when stopped by ice; by the act of June 4, 1906, for extending the limits of levee construction from the mouth of the Ohio River up to Cape Girardeau, Mo.; by the river and harbor act of July 27, 1916, for similar further extension of limits of levee construction from Cape Girardeau, Mo., up to Rock Island, Ill.; for the extension of limits of construction of both levees and revetment up the Arkansas River from its mouth to its intersection with the division line between Lincoln and Jefferson Counties; for the improvement of the Ohio River from its mouth to the mouth of Cache River; and by the flood-control act of March 1, 1917, for the construction of levees needed for flood control in addition to those needed for navigation.

*Operations and results during fiscal year.*—Sessions of the commission: The one hundred and thirty-ninth session, July 10–12, 1917, was held in St. Louis, Mo. The one hundred and fortieth session, August 2, 1917, was held in Memphis, Tenn. The one hundred and forty-first session, November 13 to 23, 1917, and the one hundred and forty-second, April 16 to 24, 1918, were held on the steamer *Mississippi* during inspections of the river from St. Louis, Mo., to New Orleans, La.

Surveys, gages, and observations: Gages were maintained and discharge observations were made on the Mississippi River and its tributaries. A total of 9,500 sheets of the Detail Charts, scale 1:20,000, resurvey from Cairo to the mouth of Red River, were printed under contract. Work was continued on the reduction and plotting of field notes of the Atchafalaya River survey.

Channel dredging: Dredges were operated during the low-water season as follows, the numbers in parentheses being distances below Cairo: Morrisons (70), Point Pleasant (80), Gayoso (104), Blue Grass (132), River Styx (139), Foot of Island 30 (161), Osceola (165), Drivers (169), Head Presidents Island (232), Foot of Cow Island (252), Fords (710), and Red River Crossing (766). The project depth of 9 feet was maintained through all bars, except that a survey made November 1 to 3 showed 8 feet as the best obtainable depth at Red

River Crossing until the arrival of the dredge. From all the above places about 1,327,016 cubic yards of material were moved. Navigation was stopped during the period December 9, 1917, to February 13, 1918, on account of abnormal ice conditions. At one time the ice gorge was continuous from Cairo to Columbus, a distance of 21 miles, and other enormous gorges existed for several days each at Barfield, Osceola, Richardsons, and Seyppels, respectively, 142, 165, 185, and 260 miles below Cairo.

Revetment: Below Cairo 27,915 linear feet of bank were revetted, and about 6,320,600 square feet of mattress were built and placed for repairs to old work.

Levees: A total of 16,527,960 cubic yards were placed in levees.

Memphis Harbor. During the year dredging operations were continued at various intervals. A total of 1,344,359 cubic yards of material were removed and a channel was maintained along the paved wharf.

The expenditures during the year are summarized below:

| Location and object.                                                               | Maintenance. | New work.    | Total expenditures. |
|------------------------------------------------------------------------------------|--------------|--------------|---------------------|
| UNITED STATES FUNDS.                                                               |              |              |                     |
| Mississippi River Commission.....                                                  | \$15,034.07  | \$36,452.47  | \$51,486.54         |
| Surveys, gages and observations.....                                               | 22,000.90    | 37,007.65    | 59,008.55           |
| Levees, Head of Passes to Rock Island, Ill.....                                    | 152,032.90   | 2,255,302.61 | 2,407,335.51        |
| Revetment and contraction works, permanent channel improvement and protection..... | 710,428.36   | 1,384,310.36 | 2,094,738.72        |
| Dredges and dredging.....                                                          | 325,746.18   |              | 325,746.18          |
| Improving Memphis Harbor (from appropriation for flood control).....               | 214,626.15   |              | 214,626.15          |
| Plant and miscellaneous.....                                                       | 235,863.11   | 314,657.17   | 550,520.28          |
| Plant waters of Mississippi River and tributaries.....                             |              | 8,217.85     | 8,217.85            |
| Total.....                                                                         | 1,675,731.67 | 4,035,948.11 | 5,711,679.78        |
| CONTRIBUTED FUNDS.                                                                 |              |              |                     |
| Levees, Head of Passes to Rock Island, Ill.....                                    | 11,411.97    | 310,272.01   | 321,683.98          |
| Revetment and contraction works, permanent channel improvement and protection..... |              | 85,500.00    | 85,500.00           |
| Total.....                                                                         | 11,411.97    | 395,772.01   | 407,183.98          |
| CONSOLIDATED UNITED STATES AND CONTRIBUTED FUNDS.                                  |              |              |                     |
| Grand total.....                                                                   | 1,687,143.64 | 4,431,720.12 | 6,118,863.76        |

*Condition at end of fiscal year.*—The general survey of the Mississippi River from Head of Passes, La., to its headwaters at Lake Itasca, Minn., has been completed and maps of the river published. The resurvey from Cairo, Ill., to the mouth of Red River, La., has been completed and maps therefrom prepared for publication are being printed. Various discharge, gage, and other observations have been made on the Mississippi River and tributaries and the Gulf of Mexico. Works for the improvement of the channel have been executed at various places below Cairo. Revetment work below Cairo is now in place and in good condition on about 97.14 miles of river bank. There are 1,508 miles of effective levees, containing about 329,057,302 cubic yards, between Head of Passes, La., and Cape Girardeau, Mo., and about 452 miles of river front protected by levees more or less effective between Cape Girardeau, Mo.,

and Rock Island, Ill. The levees below Cape Girardeau protect about 26,744 square miles of land, and those above Cape Girardeau protect about 980 square miles. About 71.8 per cent of the total yardage required to complete the levees below Cape Girardeau is now in place. Dredging, which has been done annually since 1892 below Cairo wherever necessary to maintain a navigable channel 9 feet in depth, has proved so successful that in the Mississippi River there is now, with rare exceptions, a good navigable channel at all stages, with a depth of 9 feet or more over a width of at least 250 feet for a distance of 833 miles below Cairo, and a depth of not less than 30 feet over a width of several hundred feet for the remaining 240 miles to the Gulf of Mexico. The necessary plant required for surveys, dredging, and bank-protection work has been constructed and maintained. The expenditures under the commission have been as follows:

|                          | New work.       | Maintenance.    | Total.          |
|--------------------------|-----------------|-----------------|-----------------|
| United States funds..... | \$72,332,297.03 | \$22,091,106.34 | \$94,423,403.37 |
| Contributed funds.....   | 1,122,906.30    |                 | 1,122,906.30    |
| Total.....               | 73,455,203.33   | 22,091,106.34   | 95,546,309.67   |

*Local cooperation.*—It has been almost entirely in the construction of levees and revetments that the local authorities have contributed toward the improvement of the river. The organized levee boards have for many years constructed a large portion of the existing levee line, but in recent years local interests have also contributed toward revetment construction, although such contributions have been small compared with the total cost of bank-protection works. The amount contributed to June 30, 1918, was \$1,640,201.67 for levees and \$705,987.63 for revetment.

*Terminal facilities.*—With the exception of Natchez, Miss., and New Orleans, La., there are no mechanical means of handling freight between Cairo and the Gulf. At all towns and many landings there are wharf boats or warehouses for the storing of freight. At Natchez there is an incline railway for transfer of freight between cars and boats. At New Orleans there are 5 miles of wharves, of which 3.5 miles are covered with steel sheds, the public wharves being under control of the Board of Commissioners of the Port of New Orleans and connection being made with all railroads by the municipal belt railroad.

*Effect of improvement.*—In a general way it may be stated that the improvement is providing a safe and adequate channel for navigation, and is now in condition to prevent the destructive effects of floods in all except the most extreme high waters.

*Proposed operations.*—To correct, permanently locate, and maintain the project channel depth, torevet caving banks, to complete the levee systems, and to improve the river harbors constitute the principal objects for which funds are necessary. The flood-control act provides "that not more than \$10,000,000 shall be expended therefor during any one fiscal year." It is estimated that \$4,000,000 will be required for urgent work during the fiscal year ending June 30, 1920, exclusive of the balance unexpended July 1, 1919.

*Commercial statistics.*—These are appended to the commission's report.

*Financial summary.*

UNITED STATES FUNDS (SPECIFIC APPROPRIATIONS).

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$470,849.21:

|             |                 |
|-------------|-----------------|
| New work    | \$72,332,297.03 |
| Maintenance | 22,091,106.34   |

|                    |                      |
|--------------------|----------------------|
| Net total expended | <u>94,423,403.37</u> |
|--------------------|----------------------|

|                                             |                      |
|---------------------------------------------|----------------------|
| Total appropriations to date of this report | <u>98,735,178.96</u> |
|---------------------------------------------|----------------------|

| Fiscal year ending June 30.                 | 1914           | 1915           | 1916           | 1917           | 1918           |
|---------------------------------------------|----------------|----------------|----------------|----------------|----------------|
| Expended for new work <sup>1</sup> .....    | \$5,036,356.69 | \$2,151,181.77 | \$2,188,121.14 | \$2,934,405.46 | \$4,027,730.26 |
| Expended for maintenance <sup>1</sup> ..... | 1,261,047.94   | 877,309.04     | 1,125,021.58   | 1,490,179.06   | 1,675,731.67   |
| Total expended <sup>1</sup> .....           | 6,297,404.63   | 3,028,490.81   | 3,313,142.72   | 4,424,584.52   | 5,703,461.93   |
| Appropriated or allotted.....               | 56,144.01      | 7,750,000.00   | .....          | 6,009,000.00   | 5,660,000.00   |

|                                  |                |
|----------------------------------|----------------|
| July 1, 1917, balance unexpended | \$4,319,823.93 |
|----------------------------------|----------------|

|                                                              |              |
|--------------------------------------------------------------|--------------|
| Amount allotted from sundry civil act approved June 12, 1917 | 5,660,000.00 |
|--------------------------------------------------------------|--------------|

|                                                    |           |
|----------------------------------------------------|-----------|
| Receipts from sales, etc., during fiscal year 1918 | 35,413.59 |
|----------------------------------------------------|-----------|

10,015,237.52

June 30, 1918, amount expended during fiscal year: <sup>1</sup>

|              |                |
|--------------|----------------|
| For new work | \$4,027,730.26 |
|--------------|----------------|

|                 |              |
|-----------------|--------------|
| For maintenance | 1,675,731.67 |
|-----------------|--------------|

5,703,461.93

|                                  |              |
|----------------------------------|--------------|
| July 1, 1918, balance unexpended | 4,311,775.59 |
|----------------------------------|--------------|

|                                       |            |
|---------------------------------------|------------|
| July 1, 1918, outstanding liabilities | 803,553.85 |
|---------------------------------------|------------|

|                                                       |              |
|-------------------------------------------------------|--------------|
| July 1, 1918, amount covered by uncompleted contracts | 1,957,670.72 |
|-------------------------------------------------------|--------------|

2,761,224.57

|                                 |              |
|---------------------------------|--------------|
| July 1, 1918, balance available | 1,550,551.02 |
|---------------------------------|--------------|

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Amount appropriated by sundry civil act approved July 1, 1918 | 6,670,000.00 |
|---------------------------------------------------------------|--------------|

|                                                       |                     |
|-------------------------------------------------------|---------------------|
| Amount available for fiscal year ending June 30, 1919 | <u>8,220,551.02</u> |
|-------------------------------------------------------|---------------------|

|                                                                                   |             |
|-----------------------------------------------------------------------------------|-------------|
| Amount (estimated) required to be appropriated for completion of existing project | Indefinite. |
|-----------------------------------------------------------------------------------|-------------|

|                                                                                                              |                           |
|--------------------------------------------------------------------------------------------------------------|---------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920, for new work and for maintenance | <sup>2</sup> 4,000,000.00 |
|--------------------------------------------------------------------------------------------------------------|---------------------------|

CONTRIBUTED FUNDS.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$13,812.37:

|          |              |
|----------|--------------|
| New work | 1,122,906.30 |
|----------|--------------|

|             |       |
|-------------|-------|
| Maintenance | ..... |
|-------------|-------|

|                                                |                     |
|------------------------------------------------|---------------------|
| Total net contributions to date of this report | <u>2,346,189.30</u> |
|------------------------------------------------|---------------------|

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

| Fiscal year ending June 30.                 | 1914         | 1915         | 1916         | 1917         | 1918         |
|---------------------------------------------|--------------|--------------|--------------|--------------|--------------|
| Expended for new work <sup>1</sup> .....    | \$135,009.30 | \$207,862.49 | \$135,128.21 | \$196,561.22 | \$395,772.01 |
| Expended for maintenance <sup>1</sup> ..... | 1,066.61     |              |              | 5,173.47     | 11,411.97    |
| Total expended <sup>1</sup> .....           | 136,075.91   | 207,862.49   | 135,128.21   | 201,734.69   | 407,183.98   |
| Contributed .....                           | 205,987.63   | 218,000.00   | 290,000.00   | 209,000.00   | 1,423,201.67 |

July 1, 1917, balance unexpended..... \$207,265.32  
Amount contributed by local interests..... 1,423,201.67  
1,630,466.99

June 30, 1918, amount expended during fiscal year:  
For new work..... \$395,772.01  
For maintenance..... 11,411.97  
407,183.98

July 1, 1918, balance unexpended..... 1,223,283.01  
July 1, 1918, outstanding liabilities..... 93,400.14  
July 1, 1918, amount covered by uncompleted contracts..... 678,681.58  
772,081.73

July 1, 1918, balance available..... 451,201.22

Amount that can be profitably expended in fiscal year ending  
June 30, 1920, for new work..... (2)

#### CONSOLIDATED FINANCIAL SUMMARY FOR UNITED STATES AND CONTRIBUTED FUNDS

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$484,661.58:

New work..... \$73,455,203.32  
Maintenance..... 22,091,106.32  
Net total expended..... 95,546,309.64

Total appropriations and contributions to date of this report... 101,081,368.22

| Fiscal year ending June 30.                   | 1914           | 1915           | 1916           | 1917           | 1918           |
|-----------------------------------------------|----------------|----------------|----------------|----------------|----------------|
| Expended for new work <sup>1</sup> .....      | \$5,171,365.99 | \$2,359,044.26 | \$2,323,249.35 | \$3,130,966.68 | \$4,423,502.22 |
| Expended for maintenance <sup>1</sup> .....   | 1,262,114.55   | 877,309.04     | 1,125,021.58   | 1,495,352.53   | 1,687,143.62   |
| Total expended <sup>1</sup> .....             | 6,433,480.54   | 3,236,353.30   | 3,448,270.93   | 4,626,319.21   | 6,110,645.84   |
| Appropriated, allotted, and contributed ..... | 262,131.64     | 7,968,000.00   | 290,000.00     | 6,209,000.00   | 7,083,201.67   |

July 1, 1917, balance unexpended..... \$4,527,089.22  
Amount contributed by local interests..... 1,423,201.67  
Amount allotted from sundry civil act approved June 12, 1917... 5,660,000.00  
Receipts from sales, etc., during fiscal year 1918..... 35,413.56  
11,645,704.45

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Proportional share of Federal appropriation, as provided by law.

|                                                                                                                      |                   |                   |
|----------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| June 30, 1918, amount expended during fiscal year: <sup>1</sup>                                                      |                   |                   |
| For new work-----                                                                                                    | \$4, 423, 502. 27 |                   |
| For maintenance-----                                                                                                 | 1, 687, 143. 64   |                   |
|                                                                                                                      |                   | \$6, 110, 645. 91 |
| July 1, 1918, balance unexpended-----                                                                                |                   | 5, 535, 058. 59   |
| July 1, 1918, outstanding liabilities-----                                                                           | 896, 953. 99      |                   |
| July 1, 1918, amount covered by uncompleted con-<br>tracts-----                                                      | 2, 636, 352. 30   |                   |
|                                                                                                                      |                   | 3, 533, 306. 29   |
| July 1, 1918, balance available-----                                                                                 |                   | 2, 001, 752. 30   |
| Amount appropriated by sundry civil act approved July 1, 1918--                                                      |                   | 6, 670, 000. 00   |
|                                                                                                                      |                   | 8, 671, 752. 30   |
| Amount available for fiscal year ending June 30, 1919-----                                                           |                   |                   |
| Amount (estimated) required to be appropriated for completion<br>of existing project-----                            |                   | Indefinite.       |
| Amount that can be profitably expended in fiscal year ending<br>June 30, 1920, for new work and for maintenance----- | <sup>2 3</sup>    | 4, 000, 000. 00   |

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

<sup>3</sup> This amount will be increased by the proportional share of funds to be contributed by local interests as required by law.

\* \* \* \* \*



ANNUAL REPORT OF THE MISSISSIPPI RIVER COMMISSION FOR  
THE FISCAL YEAR ENDING JUNE 30, 1918.

OFFICE, MISSISSIPPI RIVER COMMISSION,  
*St. Louis, Mo., July 24, 1918.*

From: The Mississippi River Commission.  
To: The Chief of Engineers, United States Army.  
Subject: Annual Report for 1918.

The act of June 28, 1879, by which the commission was created, defines its duties in part as follows:

To direct and complete such surveys of said river, between the Head of the passes near its mouth to its headwaters as may now be in progress, and to make such additional surveys, examinations, and investigations, topographical, hydrographical, and hydrometrical, of said river and its tributaries as may be deemed necessary by said commission to carry out the objects of this act.

\* \* To take into consideration and mature such plan or plans and estimates as will correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River; improve and give safety and ease to the navigation thereof; prevent destructive floods; promote and facilitate commerce, trade, and the postal service; \* \* \*

Under the authority of this and subsequent acts making appropriations and relating to the subject, surveys and observations have been carried on and works of improvement under the authority and direction of laws making appropriations for that purpose have been undertaken and executed. The original project contained in the report of the Mississippi River Commission dated February 17, 1880, contemplated the permanent fixing and improvement of the channel to a depth of at least 10 feet at extreme low water by the contraction of the low-water width to about 3,000 feet, the protection of the banks against caving, and the control of the flood waters by means of levees. This report was the one upon which Congress made its first appropriation for the improvement of the Mississippi river under commission plans, thereby officially adopting such plans or the inauguration of this work.

When the Mississippi River Commission began the work of improvement there were few, if any, precedents of practical value to serve as guides in a project of such magnitude. But very meager data as to the regimen of the river were available, and a thorough knowledge of its many varying phases was essential before satisfactory comprehensive plans of improvement could be developed. Exhaustive surveys and observations of the physics of the river from the headwaters to the mouth were therefore inaugurated and carried on until the data needed were secured and experiments with various kinds of plant and material were also made in order to develop the equipment and type of construction needed for efficient work. This work occupied several years. During these years the appropriations were comparatively small, and sometimes failed altogether, with disastrous results to the channel works, so progress was necessarily slow. As a result of the knowledge of the regimen of the river

acquired and the lessons taught by the experimental work, definite projects are now entered upon with confidence of success, but effort looking to improved methods to secure greater efficiency and economy will be continued.

The earlier works were designed primarily for the rectification and improvement of the channel, and were confined to the Plum Point Reach, 147 to 186 miles, and Lake Providence Reach, 517 to 552 miles below Cairo. These reaches were selected because here the shifting sand bars and deficient depths were most pronounced and the low-water navigation most difficult. Highly beneficial results were obtained in the improvement of the channel depths in those reaches, and the work done in them confirmed the soundness of the theory upon which it was based, but also demonstrated that more substantial types of construction were needed and that the permanent improvement of the channel by contraction and revetment work would consume a long period of time, while the pressing needs of commerce called for immediate relief. The development in hydraulic dredging machinery had reached such a stage at this time as to hold out the hope that an immediate and economical solution of the problem of temporarily deepening the channel for navigation purposes might be found in the opening and maintenance of channels across the obstructing bars at each low-water season by means of dredging. After extended studies and experiments, hydraulic dredges of large capacity adapted to the peculiar service required were developed by the commission and this method of temporary improvement of the low-water channel was adopted with a view to maintaining a navigable channel not less than 250 feet in width and 9 feet in depth, and has been applied with success.

Since the adoption of dredging, the permanent work of channel improvement has been confined to the revetment of banks, and a type of revetment has been developed which successfully withstands the scouring action of the river. Concrete has been largely substituted for the upper bank revetment, and its use for sinking the present type of willow mat, as well as a possible substitute for the mat itself is being tried out with a view to further economy and increased efficiency.

The extent of bank revetment is, however, relatively so great when compared to the funds available for its construction that it has been necessary to confine the work to cases of urgent necessity, such as caving banks which threaten cut-offs or the safety of large levees which could only be replaced at excessive cost, and the harbor fronts of cities. Substantial revetment for the purpose of fixing the banks of the river is essential to any successful scheme of improvement and as the project adopted by Congress requires that the commission shall "correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River," large increase in expenditures for revetment construction are urgently needed.

An important item in the operation of the commission is the construction and general repair of levees, which was first authorized without qualifying restrictions by the act of September 19, 1890, and since that date about one-half of the appropriations made by Congress have been devoted to that purpose.

Briefly stated in general terms and quoting in part the several acts of Congress under which the project is being carried out, the work

in progress covers the Mississippi River from Rock Island, Ill., to the Head of the Passes, 1,568 miles, "the Ohio River from its mouth to the mouth of the Cache River," and "the Arkansas River between its mouth and the intersection thereof with the division line between Lincoln and Jefferson Counties," and it includes—

Flood protection by construction, extension, and repair of levees from Rock Island, Ill., to Head of the Passes, 1,568 miles; along the Ohio River between the mouth of the Cache River and the Arkansas River up to the Lincoln-Jefferson County line, in cooperation with the several States and levee boards, to prevent destructive floods."

Continuation of improvement below the mouth of the Ohio River so as to "give safety and ease to navigation" of the Mississippi River at flood stages "facilitating the interchange of traffic, "commerce, trade, and the Postal Service, with a view to securing a permanent channel depth of 9 feet" by means of:

(a) Revetment of caving banks to "correct, permanently locate, and deepen the channel, and protect the banks of the Mississippi River," and for the preservation of harbors and the security of levees.

(b) Dredging, for the purpose of maintaining at all stages a "navigable channel 250 feet in width and 9 feet in depth," including construction, operation, and maintenance of suitable dredge boats and auxiliary devices and appliances therefor.

The maintenance of a navigable channel between the waters of the Mississippi, Red, and Atchafalaya Rivers.

Physical investigations, maintenance of gauges, and discharge measurements of the Mississippi River and its tributaries, preparation and publication of maps and physical data; surveys and investigations covering all phases of river regimen governing the work of channel improvement and flood control from the headwaters of the Mississippi River to the Head of the Passes."

Other miscellaneous details incident to the execution of the general project.

#### LEEVE WORK ABOVE CAPE GIRARDEAU, MO.

The river and harbor act approved March 4, 1913, appropriated a sum of \$200,000 for the purpose of making an examination of the Mississippi River from Cape Girardeau, Mo., to Rock Island, Ill.—

with a view to such improvements as will at the same time promote navigation, develop water power, and protect property adjacent to said river from damage by floods; \* \* \* and for the building of such levees between said points on the river in aid of navigation as may be found necessary or desirable by the commission and approved by the Chief of Engineers.

The river and harbor act approved July 27, 1916, provides that—

funds which are herein, or may hereafter be, appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended, under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, for levees upon any part of said river between Head of Passes and Rock Island, Illinois, in such manner as, in their opinion, shall best improve navigation and promote the interests of commerce at all stages of the river.

The flood control act approved March 1, 1917, provides in paragraph (c) of section 1 that—

funds which may hereafter be appropriated under authority of this act for improving the Mississippi River between the Head of the Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended upon any part of said river between the Head of the Passes and Rock Island, Illinois.

## EXTENSION OF JURISDICTION OF THE MISSISSIPPI RIVER COMMISSION.

The river and harbor act approved July 27, 1916, provides:

That the water courses connected with said river and the harbors upon it, now under the control of the Mississippi River Commission and under improvement, together with the harbor at Vicksburg, Mississippi, and the Ohio River from its mouth to the mouth of the Cache River, which are hereby transferred to and placed under the control and jurisdiction of such commission, may, in the discretion of said commission, upon approval by the Chief of Engineers, receive allotments for improvements now under way or hereafter to be undertaken, to be paid for from the amount herein appropriated.

\* \* \* \* \*

*Provided further,* That no part of the improvement of the Ohio River, with a view to the construction of locks and dams, shall be considered as transferred to or placed under the control and jurisdiction of the Mississippi River Commission.

The same act provides that—

The jurisdiction of the Mississippi River Commission is hereby extended so as to include that part of the Arkansas River between its mouth and the intersection thereof with the division line between Lincoln and Jefferson Counties, and any funds which are herein or may be hereafter appropriated by Congress for improving the Mississippi River between Head of Passes and the mouth of the Ohio River, and which may be allotted to levees and bank revetment, may be expended within the limits of said extended jurisdiction, under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, and upon like terms and conditions for levees and bank revetment upon any part of the Mississippi River now under the jurisdiction of said commission, and in such manner as will best promote and accomplish the purposes for which the commission was created, in so far as the territory hereby added to its said jurisdiction may be involved.

The flood-control act, approved March 1, 1917, further provides:

That the water courses connected with the Mississippi River to such extent as may be necessary to exclude the flood waters from the upper limits of any delta basin, together with the Ohio River from its mouth to the mouth of Cache River, may, in the discretion of said commission, receive allotments for improvements now underway or hereafter to be undertaken.

POLICY ADOPTED BY THE MISSISSIPPI RIVER COMMISSION FOR WORK UNDER  
THE FLOOD-CONTROL ACT APPROVED MARCH 1, 1917.

"The Mississippi River Commission must be governed by and rigidly conform to the terms of the flood-control act, and the hearty co-operation of all levee boards is looked for in order to carry on the work of levee construction in a satisfactory and economical manner.

"The money to be appropriated under authority of the flood-control act is 'for controlling the floods and for the general improvement of the Mississippi River,' etc., and the amounts to be devoted to the construction of levees and other classes of work will, as heretofore, be determined by the Mississippi River Commission from time to time as appropriations are made, and in accordance with policy of the commission as heretofore adopted.

"Under the law the amount contributed by local interests for the construction or repair of any levee 'shall not be less than one-half of such sums as may have been allotted by the commission.' The commission will determine in each case what proportion is 'just and equitable' when the allotments of funds of successive appropriations are made. No funds can be expended by the commission under the flood-

control act for levee work in any levee district 'between the Head of the Passes and Rock Island, Illinois,' unless the contribution of funds thereto required by law be first made.

"The amounts contributed by local levee boards must be in current funds, deposited in the United States Treasury or acceptable depository, to the credit of the Mississippi River Commission. In accordance with a ruling of the Treasury Department, interest accruing, if any, on such deposits, may be payable by the depository to the levee boards which have made such deposits in compliance with the law.

"The terms of the flood-control act prohibit the expenditure of funds for levee purposes in any levee district unless a minimum of one-third of the amount required is contributed by the said district.

"No credit will be given to any levee district for work done or money expended on the construction of levees prior to the allotment of funds therefor by the commission from the appropriations authorized by the flood-control act, and contributions from levee boards required by law must be in current funds.

"All levee construction and the disbursement of funds from commission allotments and the contributions from levee districts shall be under the direction of the Mississippi River Commission and its authorized agents.

"No money allotted by the commission under authority of the flood-control act can be expended for right of way but 'all such rights of way must be provided free of cost to the United States' by the several levee districts; furthermore, 'no money paid as expenses incurred by any State or levee district in securing such right of way or in any temporary works of emergency, or for the maintenance of any levee line, shall be computed as a part of the contribution of such State or levee district' toward the allotment made by the commission.

"The maintenance of a completed levee, constructed in whole or in part under the flood-control act, must be cared for by the levee district protected thereby.

"Competent experienced engineers and inspectors in the service of the levee boards may be transferred to the service of the commission, under civil service regulations, as the exigencies of the work may require.

"Section (b) of the flood-control act provides that contributions from levee districts apply solely to the construction and repair of levees. Revetment work, therefore, is regarded as exempt from the ratio of contribution prescribed by this law."

A resolution passed by the Mississippi River Commission, July 12, 1917, requires—

that each levee district on the Mississippi River under the control of the Mississippi River Commission be advised that the cash contribution for the construction of levees in such district, after an allotment of funds by the Mississippi River Commission under the provisions of the flood-control act, approved March 1, 1917, must be made within 90 days after notice of such allotment, except where the commission specially authorizes other action.

#### APPROPRIATIONS AND ALLOTMENTS.

Since the creation of the Mississippi River Commission there has been appropriated and allotted for expenditure under it on the Mississippi River and tributaries \$96,375,610.68.

From the appropriation of \$6,000,000 carried in the sundry civil act of June 12, 1917, for carrying out the provisions of the flood-control act approved March 1, 1917, an allotment of \$5,660,000 was approved by the Secretary of War June 22, 1917, for the work of the Mississippi River Commission. On recommendation of the commission, allotments were made during the year as follows:

## SECRETARY.

|                                                   |                     |
|---------------------------------------------------|---------------------|
| Mississippi River Commission                      | \$50,000            |
| Surveys, gauges and observations                  | 40,000              |
| Dredges and dredging                              | 350,000             |
| New steamer                                       | 196,000             |
| Levees—Cape Girardeau, Mo., to Rock Island, Ill.: |                     |
| Rock Island to New Boston, Ill.                   | 55,000              |
| Muscatine to mouth of Iowa River, Iowa            | 30,000              |
| Warsaw to Quincy, Ill.                            | 55,000              |
| Mouth of Des Moines River to La Grange, Mo.       | 20,000              |
| La Grange to mouth of Missouri River, Mo.         | 70,000              |
| Grand Tower to Gale, Ill.                         | 50,000              |
|                                                   | <hr/> 916,000 <hr/> |

## FIRST AND SECOND DISTRICTS.

|                                                                                  |                       |
|----------------------------------------------------------------------------------|-----------------------|
| Revetment:                                                                       |                       |
| Gayoso, Mo.                                                                      | 50,000                |
| Barfield, Ark.                                                                   | 100,000               |
| Porter Lake, Ark.                                                                | 130,000               |
| Old Town Bend, Ark.                                                              | 40,000                |
| General repairs and stone                                                        | 35,000                |
| Osceola, Ark.                                                                    | 45,000                |
| Revetment plant:                                                                 |                       |
| 12 new wooden barges                                                             | 65,000                |
| 1 new gravel dredge                                                              | 15,000                |
| 6 new gravel barges                                                              | 48,000                |
| Care and repair of plant                                                         | 75,000                |
| Memphis harbor (dipper dredge, \$65,000; examination and bar removal, \$185,000) | 250,000               |
| Surveys                                                                          | 5,000                 |
| Levees:                                                                          |                       |
| Upper St. Francis levee district                                                 | 90,000                |
| Reelfoot levee district                                                          | 10,000                |
| Lower St. Francis levee district                                                 | 450,000               |
| White River levee district                                                       | 110,000               |
|                                                                                  | <hr/> 1,518,000 <hr/> |

## THIRD DISTRICT.

|                           |         |
|---------------------------|---------|
| Revetment:                |         |
| Greenville, Miss.         | 40,000  |
| Ashbrook Neck, Miss.      | 102,000 |
| Filters, Miss.            | 130,000 |
| Princeton, Miss.          | 120,000 |
| Reid-Bedford, La.         | 52,000  |
| Cottonwood, Miss.         | 140,000 |
| Grand Lake, Ark.          | 80,000  |
| General repairs and stone | 50,000  |
| Plant:                    |         |
| New hull for tug Parker   | 10,000  |
| Gravel dredge             | 20,000  |
| Gasoline launch           | 3,000   |
| Care and repair           | 75,000  |
| Surveys                   | 5,000   |

|                                  |                         |
|----------------------------------|-------------------------|
| Levees:                          |                         |
| Lower Yazoo levee district.....  | \$510, 000              |
| Upper Tensas levee district..... | 420, 000                |
|                                  | <hr/> 1, 757, 000 <hr/> |

## FOURTH DISTRICT.

|                                  |                         |
|----------------------------------|-------------------------|
| Revetment:                       |                         |
| Hard Times Bend, La.....         | 25, 000                 |
| Bondurant Chute, La.....         | 25, 000                 |
| Kempe Bend, La.....              | 100, 000                |
| Giles Bend, Miss.....            | 35, 000                 |
| Marengo Bend, La.....            | 30, 000                 |
| Natchez Front, Miss.....         | 10, 000                 |
| Grand Bay, La.....               | 150, 000                |
| Plaquemine, La.....              | 75, 000                 |
| New Orleans Harbor, La.....      | 150, 000                |
| General repairs and stone.....   | 34, 000                 |
| Plant, care and repair.....      | 75, 000                 |
| Atchafalaya and Red Rivers.....  | 15, 000                 |
| Surveys.....                     | 5, 000                  |
| Levees:                          |                         |
| Lower Tensas levee district..... | 315, 000                |
| Atchafalaya levee district.....  | 130, 000                |
| Lafourche levee district.....    | 85, 000                 |
| Ponchartrain levee district..... | 80, 000                 |
| Barataria levee district.....    | 80, 000                 |
| Lake Borgne levee district.....  | 50, 000                 |
|                                  | <hr/> 1, 469, 000 <hr/> |

The following reallocations of funds from prior appropriations have been made during the year:

## SECRETARY.

|                                                                                                                         |              |
|-------------------------------------------------------------------------------------------------------------------------|--------------|
| From 1913 allotment for levees La Grange to mouth of Missouri River, Mo., to levees Rock Island to New Boston, Ill..... | \$2, 146. 28 |
| From 1916 allotment for levees, head Chouteau Island to Prairie du Pont, Ill., to levees—                               |              |
| Muscatine to Iowa River, Iowa.....                                                                                      | 5, 500. 00   |
| Warsaw to Quincy.....                                                                                                   | 5, 600. 00   |

## FIRST AND SECOND DISTRICTS.

|                                                                                    |              |
|------------------------------------------------------------------------------------|--------------|
| From 1916 allotment for revetment, Bullerton, Ark., to—                            |              |
| Revetment, Norfolk, Miss.....                                                      | 40, 000. 00  |
| Lower St. Francis levee district.....                                              | 40, 000. 00  |
| From 1914-15 river and harbor acts to levee, Upper St. Francis levee district..... | 170, 015. 47 |
| From 1913 allotment for Helena, Ark., to revetment Osceola, Ark....                | 25, 000. 00  |

## THIRD DISTRICT.

|                                                                                                                         |             |
|-------------------------------------------------------------------------------------------------------------------------|-------------|
| From allotment for Lower Yazoo levee district, \$20,000, and Reid-Bedford Bend, \$30,000, to plant, third district..... | 50, 000. 00 |
|-------------------------------------------------------------------------------------------------------------------------|-------------|

In addition to the above the sum of \$9,100 was allotted by the Chief of Engineers for the fiscal year ending June 30, 1918, from the permanent indefinite appropriation made by act of August 11, 1888, as amended by act of June 13, 1902, for gauging the waters of the Mississippi River and its tributaries, which is applied to the maintenance of certain river gauges.

*Statement of condition of "funds contributed by local levee districts under flood-control act," fiscal year 1918, in hands of Brig. Gen. W. H. Bixby, United States Army, retired.*

| Levee district.                                                                                | Bank in which funds are deposited.                 | Amount contributed. | Amount withdrawn and deposited to Treasurer, United States during fiscal year 1918. | Balance available June 30, 1918. |
|------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------|-------------------------------------------------------------------------------------|----------------------------------|
| <b>Secretary:</b>                                                                              |                                                    |                     |                                                                                     |                                  |
| Muscataine-Louisa Island levee district (Muscataine to mouth of Iowa River.)                   | First National Bank, Muscatine, Iowa.              | \$15,000.00         | \$5,000.00                                                                          | \$10,000.00                      |
| Drury drainage district (Rock Island to New Boston, Ill.)                                      | Hershey State Bank, Muscatine, Iowa.               | 27,500.00           | 10,000.00                                                                           | 17,500.00                        |
| Hunt drainage district (Warsaw to Quincy, Ill.)                                                | The Hill-Dodge Banking Co., Warsaw, Ill.           | 27,500.00           | 5,000.00                                                                            | 22,500.00                        |
| Riverland levee district (La Grange to mouth of Missouri River, Mo.)                           | Ayers National Bank, Jacksonsville, Ill.           | 33,000.00           | 5,000.00                                                                            | 28,000.00                        |
| East Cape Girardeau and Clear Creek drainage district (Grand Tower to Gale, near Thebes, Ill.) | Alexander County National Bank, Cairo, Ill.        | 25,000.00           | 10,000.00                                                                           | 15,000.00                        |
| Gregory drainage district (mouth of Des Moines River to La Grange, Mo.)                        | Treasurer, United States.....                      | 7,200.00            | 7,200.00                                                                            | .....                            |
|                                                                                                |                                                    | 135,200.00          | 42,200.00                                                                           | 93,000.00                        |
| <b>First and second districts:</b>                                                             |                                                    |                     |                                                                                     |                                  |
| Mississippi County levee board (Upper St. Francis levee).                                      | Charleston Bank, Charleston, Mo.                   | 45,000.00           | .....                                                                               | 45,000.00                        |
| Fulton County levee board (Reelfoot levee).                                                    | Treasurer, United States.....                      | 5,000.00            | 5,000.00                                                                            | .....                            |
| St. Francis levee board of Missouri (Lower St. Francis levee).                                 | First National Bank, Caruthersville, Mo.           | 22,000.00           | 22,000.00                                                                           | .....                            |
| St. Francis levee board of Arkansas (Lower St. Francis levee).                                 | National City Bank, Memphis, Tenn.                 | 225,500.00          | .....                                                                               | 225,500.00                       |
| Laconia levee district (White River levee).                                                    | St. Louis Union Bank, St. Louis, Mo.               | 55,000.00           | 55,000.00                                                                           | .....                            |
|                                                                                                |                                                    | 352,500.00          | 82,000.00                                                                           | 270,500.00                       |
| <b>Third district:</b>                                                                         |                                                    |                     |                                                                                     |                                  |
| City of Greenville, Miss.....                                                                  | Citizens Bank, Greenville, Miss.                   | 13,000.00           | 13,000.00                                                                           | .....                            |
| Southeast Arkansas levee district (Upper Tensas levee).                                        | Desha Bank & Trust Co., Arkansas City, Ark.        | 46,666.67           | 5,000.00                                                                            | 41,666.67                        |
| Mississippi levee commissioners (Lower Yazoo levee).                                           | Commercial Savings Bank, Greenville, Miss.         | 222,501.00          | 222,501.00                                                                          | 70,000.00                        |
| Tensas Basin levee district (Upper Tensas levee).                                              | The Richland State Bank, Rayville, La.             | 92,000.00           | 44,000.00                                                                           | 48,000.00                        |
| Fifth Louisiana levee district (Upper Tensas levee).                                           | First National Bank, Vicksburg, Miss.              | 71,334.00           | 61,334.00                                                                           | 10,000.00                        |
|                                                                                                |                                                    | 515,501.67          | 345,835.00                                                                          | 159,666.67                       |
| <b>Fourth district:</b>                                                                        |                                                    |                     |                                                                                     |                                  |
| Fifth Louisiana levee district (Lower Tensas levee).                                           | First National Bank, Vicksburg, Miss.              | 157,500.00          | .....                                                                               | 157,500.00                       |
| Buras levee board (Barataria levee).                                                           | Whitney-Central Trust & Savings Bank, New Orleans. | 8,000.00            | .....                                                                               | 8,000.00                         |
| Lake Borgne levee district (Lake Borgne levee).                                                | .....do.....                                       | 25,000.00           | .....                                                                               | 25,000.00                        |
| Lafourche Basin levee district (Lafourche and Barataria levees).                               | .....do.....                                       | 74,500.00           | .....                                                                               | 74,500.00                        |
| Pontchartrain levee district.....                                                              | .....do.....                                       | 40,000.00           | .....                                                                               | 40,000.00                        |
| Atchafalaya Basin levee board..                                                                | Bank of Baton Rouge, Baton Rouge, La.              | 65,000.00           | .....                                                                               | 65,000.00                        |
|                                                                                                |                                                    | 370,000.00          | .....                                                                               | 370,000.00                       |

<sup>1</sup> For revetment.

<sup>2</sup> Includes \$22,500 for revetment.

June 30, 1918:

Amount received during fiscal year, 1918..... \$1,373,201.

Amount deposited to Treasurer, United States, during fiscal year..... 470,035.

Balance available, June-30, 1918..... 903,166.

## MISSISSIPPI RIVER COMMISSION.

*Commissioners.*—The commissioners during the fiscal year were Col. J. G. Warren, Corps of Engineers, United States Army, acting president to July 10; Brig. Gen. W. H. Bixby, United States Army, retired, acting president, July 10–18, president from July 18, 1917; J. A. Ockerson, civil engineer; Homer P. Ritter, hydrographic and geodetic engineer, United States Coast and Geodetic Survey; Charles H. West, civil engineer; Col. Lansing H. Beach, Corps of Engineers, United States Army; and Edward A. Glenn.

*Secretary and district engineers.*—The following engineers were on duty under the commission during the year: Secretary, Lieut. Col. Clarke S. Smith, Corps of Engineers, United States Army, to August 23; Brig. Gen. W. H. Bixby, United States Army, retired, from August 23 to November 10; E. J. Thomas, assistant engineer, from November 10, 1917. First and second districts engineer, Lieut. Col. G. P. Howell, Corps of Engineers, United States Army, to November 9; Montgomery Gardner, assistant engineer, from November 10, 1917. Third district engineer, Maj. John R. Slattery, Corps of Engineers, United States Army, to August 27; Lieut. Col. G. P. Howell, Corps of Engineers, United States Army, from August 27 to September 24; A. M. Todd, assistant engineer, from September 24, 1917. Fourth district engineer, Lieut. Col. G. McC. Derby, United States Army, retired.

*Sessions.*—Four sessions of the commission were held during the fiscal year. The one hundred and thirty-ninth session, July 10–12, 1917, was held in the offices of the commission, International Life Building, St. Louis, Mo. The one hundred and fortieth session was held at Memphis, Tenn., August 2. The one hundred and forty-first and one hundred and forty-second sessions were held on board the steamer *Mississippi* during inspections of the river from St. Louis, Mo., to New Orleans, La., November 13–23, 1917, and April 16–24, 1918, respectively.

At these sessions public hearings were given to representatives of the navigation, levee, commercial, and other interests of the river.

## SURVEYS, GAUGES, AND OBSERVATIONS.

The general survey of the Mississippi River has been completed from Head of Passes to its headwaters, and the maps and charts published. A resurvey of the river from Cairo to the mouth of Red River, a distance of 772 miles, was completed in 1914, the reduction of field notes and mapping has been completed. A contract has been let for the printing of maps, scale 1 inch=1 mile, and charts, scale 1:20,000, of the resurvey, and is now about 24 per cent completed.

The reduction of field notes of the survey of the Atchafalaya River from Red River to Morgan City, La., is in progress, the reduction and platting are about 60 per cent completed.

Discharge observations of the river and many of its tributaries have been made at high and low water, river and tide gauges maintained, and other physical data collected. (For details see Appendix 1.)

## DREDGES AND DREDGING.

For the purpose of maintaining a channel at least 9 feet deep and 250 feet in width at all stages of the river, 10 dredges have been constructed. A navigable channel has been maintained since 1895, and a channel of project dimensions has been maintained since 1902, except as follows: For 18 days in 1903 and a few days in 1904, the depths at one bar were 8 and 8½ feet. For a few days there was a depth of between 8 and 9 feet at five bars in 1908, seven bars in 1910, five bars in 1914, two bars in 1916, and one bar in 1917. For a few days there was a depth of between 7 and 8 feet at one bar in 1908. For a few days at one bar in 1913, and four bars in 1916, the required width was not maintained.

During the dredging season of 1917, four dredges were used and maintained the project depth of 9 feet with width of 250 feet at all bars below Cairo with the exception of the bar at the mouth of Red River where a least depth of 8 feet prevailed for a short time prior to dredging at this place.

The river was comparatively high on the first of August, the gauge at Cairo reading 25.2 feet. After the first week in August the fall was slow, remaining above 10 feet until September 24. With exception of one short rise that crested at 19.2 feet on the Cairo gauge, on November 9, the river remained at a low stage until the end of December, at which date navigation was closed by ice at various points above Helena, Ark., and continuously above Columbus, Ky.

The dredges were in the field from August 9 until December 31, except that the *Gamma* which had been working at entrance to Old River and was delayed by shortage of coal and running ice, did not reach the dredge fleet at West Memphis, Ark., until February 15, 1918. (For details see Appendix 1.)

Navigation was stopped during the period December 9, 1917, to February 13, 1918, on account of abnormal ice conditions. At one time a gorge of broken ice was continuous from Cairo down to Columbus, a distance of 21 miles, and other enormous similar gorges existed for several days each at Barfield, Osceola, Richardsons, and Seyppels, respectively 142, 165, 185, and 260 miles below Cairo. Above Cairo the ice was unbroken and continuous for several weeks.

## REVETMENT WORK.

There is summarized in the following table the total lengths of the existing revetments and the amounts constructed during the year. (For details see Appendixes 2, 3, and 4.)

*Mississippi River, mouth of the Ohio River to Head of Passes—effective length of bank protection, June, 1918, and length built during the year.*

| Locality.                       | Miles below Cairo. | Bank of river. | Built during the year. | Revetment in place. |
|---------------------------------|--------------------|----------------|------------------------|---------------------|
|                                 |                    |                | <i>Lin. ft.</i>        | <i>Lin. ft.</i>     |
| Columbus, Ky. ....              | 21                 | Left. ....     |                        | 2,200               |
| Hickman, Ky. ....               | 36                 | do. ....       |                        | 1,400               |
| Slough Landing Neck, Tenn. .... | 60                 | do. ....       |                        | 16,364              |
| New Madrid, Mo. ....            | 71                 | Right. ....    |                        | 4,450               |
| Gayoso Bend, Mo. ....           | 106                | do. ....       | 2,200                  | 7,778               |
| Caruthersville, Mo. ....        | 110                | do. ....       |                        | 2,400               |
| Barfield, Ark. ....             | 141                | do. ....       | 2,822                  | 6,297               |

*Mississippi River, mouth of the Ohio River to Head of Passes—effective length of bank protection, June, 1918, and length built during the year—Continued.*

| Locality.                       | Miles below Cairo. | Bank of river. | Built during the year. | Revetment in place. |
|---------------------------------|--------------------|----------------|------------------------|---------------------|
|                                 |                    |                | <i>Lin. ft.</i>        | <i>Lin. ft.</i>     |
| Plum Point Reach:               |                    |                |                        |                     |
| Daniels Point, Ark.             | 152                | Right          |                        |                     |
| Ashport, Tenn.                  | 455-159            | Left           |                        |                     |
| Fletchers Bend, Ark.            | 158-161            | Right          |                        | 75,380              |
| Osceola, Ark.                   | 163-165            | do.            |                        |                     |
| Bullerton Bar, Ark.             | 168                | do.            |                        |                     |
| Golden Lake, Ark.               | 192                | do.            |                        | 3,000               |
| Hopefield Bend, Ark.            | 227-230            | do.            |                        | 14,800              |
| Memphis, Tenn.                  | 230-232            | Left           |                        | 14,800              |
| Tennessee Chute, Tenn.          | 237                | do.            |                        | 1,000               |
| Norfolk, Miss.                  | 254                | do.            | 1,004                  | 1,004               |
| Star Landing, Miss.             | 257                | do.            |                        | 7,535               |
| Porter Lake, Ark.               | 261                | Right          | 2,790                  | 8,612               |
| Walnut Bend, Ark.               | 281                | do.            |                        | 7,160               |
| Trotters Landing, Miss.         | 304                | Left           |                        | 6,625               |
| Helena, Ark.                    | 306                | Right          |                        | 5,000               |
| Delta, Miss.                    | 315                | Left           |                        | 7,195               |
| Old Town Bend, Ark.             | 324                | Right          | 2,484                  | 8,484               |
| Sunflower, Miss.                | 355                | Left           |                        | 9,670               |
| Red Fork, Ark., Arkansas River. | 402                | Right          | 3,000                  | 4,200               |
| Lake Bolivar Front.             | 417                | Left           |                        | 8,640               |
| Ashbrook Neck.                  | 446                | do.            | 1,100                  | 12,250              |
| Panther Forest.                 | 452                | Right          |                        | 7,500               |
| Leland Neck, Ark.               | 471                | do.            |                        | 5,000               |
| Greenville, Miss.               | 478                | Left           | 1,070                  | 23,000              |
| Vauchuse, Ark.                  | 487                | Right          |                        | 3,925               |
| Longwood, Miss.                 | 500                | Left           |                        | 4,200               |
| Grand Lake, Ark.                | 510                | Right          |                        | 8,500               |
| Princeton, Miss.                | 514                | Left           | 700                    | 700                 |
| Lake Providence Reach:          |                    |                |                        |                     |
| Louisiana Bend.                 | 522                | Right          |                        | 11,300              |
| Lake Providence, La.            | 540                | do.            |                        | 12,000              |
| Fitters Bend, Miss.             | 550                | Left           | 4,750                  | 13,200              |
| Cottonwood, Miss.               | 558                | do.            | 2,000                  | 9,900               |
| Albemarle Bend, Miss.           | 568                | do.            |                        | 13,720              |
| Delta Point, La.                | 598                | Right          |                        | 5,900               |
| Ficksburg, Miss.                | 599                | Left           | 2,500                  | 4,300               |
| Reid-Bedford Bend, La.          | 603                | Right          | 460                    | 7,230               |
| Hard Times Bend, La.            | 633                | do.            |                        | 7,689               |
| Bondurant.                      | 643                | do.            |                        | 4,150               |
| Kempe.                          | 658                | do.            |                        | 28,616              |
| Giles Bend.                     | 687-691            | Left           |                        | 20,917              |
| Marengo Bend.                   | 693                | Right          |                        | 12,844              |
| Natchez Front.                  | 700                | Left           |                        | 3,536               |
| Grand Bay.                      | 808                | Right          |                        | 3,180               |
| Plaquemine, La.                 | 854                | do.            |                        | 6,370               |
| Avondale, La.                   | 953                | do.            |                        | 1,615               |
| New Orleans Harbor.             | 960-970            | Right and left | 1,035                  | 56,750              |
| Total.                          |                    |                | 1 27,915               | 2 512,886           |

<sup>1</sup> 5.29 miles.

<sup>2</sup> 97.14 miles.

#### MEMPHIS HARBOR.

Repairs were made to the revetment just below the river and rail incline, and a channel along the paved wharf was maintained by dredging. Dredging was continued in Loosahatchie and Wolf Rivers, and in the harbor proper, by which a channel was maintained throughout the year deep enough and wide enough for the needs of all boats desiring to use the harbor.

#### RIVER STAGES DURING THE YEAR.

The stage of the Mississippi River remained moderately high until the early part of August, remaining above 20 feet on the Cairo gauge until August 6. From August 6 to September 22 the stage declined gradually, the gauge reading 10.4 feet on September 23. The river remained practically stationary and below 10 feet, with exception of 4 days, until October 27, when a rise set in that crested at 19.2 feet

on November 9. The river again fell and the lowest stage of the year, 4 feet (due partly to ice dams in the upper rivers), was reached on December 16 and 17. The river remained below 10 feet until the end of December, when the formation of an ice gorge near Columbus, Ky., 21 miles below Cairo, caused a rise which crested at 37.4 feet on January 30, when the ice gorge near Columbus went out and the river fell at first rapidly and then slowly to 27.3 feet. Heavy rains and mild weather in the early part of February produced another rise which crested on February 25 at 39.8 feet, this being the highest reading, at Cairo, for the year.

#### LEVEES.

For convenience in administration and allotment of funds for levee purposes, the river front below Cape Girardeau, Mo., has been divided by the commission into levee districts. The names and locations of these districts as now established by the commission are as given on pages 3718-3719 of report of the Chief of Engineers for 1912. Levee construction from Cape Girardeau, Mo., to Rock Island, Ill., provided for by the river and harbor act approved July 27, 1916, and the flood-control act approved March 1, 1917, is in charge of the secretary, Mississippi River Commission, and the names and descriptions of localities to which allotments have been made are as follows:

- Left bank from Rock Island to New Boston, Ill. ('507 to 458).
- Right bank from Muscatine to mouth of Iowa River, Iowa. ('481 to 460).
- Left bank from Oquawka to Dallas, Ill. ('441 to 414).
- Left bank from Warsaw to Quincy, Ill. ('381 to 348).
- Right bank from mouth of Des Moines River to La Grange, Mo. ('381 to 356).
- Right bank from La Grange to mouth of Missouri River, Mo. ('357 to 208).
- Left bank from Quincy to Hamburg Bay, Ill. ('348 to 282).
- Left bank, head of Chouteau Island to Prairie du Pont, Ill. ('208 to 185).
- Left bank, Grand Tower to Gale, near Thebes, Ill. ('84 to 48).

The following table, which is similar to that given in previous reports, has been brought up to date and shows the present condition of levees below Cape Girardeau, and levee operations during the past year, as compiled from the reports of the district engineers:

| Levee district.        | In system.         | Built.        | Contents, 1917.     | Built since by United States. | Built since by local authorities. | Total built since 1917. |
|------------------------|--------------------|---------------|---------------------|-------------------------------|-----------------------------------|-------------------------|
|                        | <i>Miles.</i>      | <i>Miles.</i> | <i>Cubic yards.</i> | <i>Cubic yards.</i>           | <i>Cubic yards.</i>               | <i>Cubic yards.</i>     |
| Upper St. Francis..... | 87.00              | 67.00         | 6,381,303           | 877,755                       |                                   | 877,755                 |
| Lower St. Francis..... | 218.00             | 211.00        | 43,889,142          | 1,353,696                     | 291,418                           | 1,645,114               |
| White River.....       | 74.00              | 74.00         | 16,052,663          | 635,368                       | 181,924                           | 817,292                 |
| Reelfoot.....          | 21.00              | 21.00         | 2,719,368           | 169,347                       |                                   | 169,347                 |
| Upper Yazoo.....       | 124.00             | 124.00        | 38,106,392          |                               | 604,958                           | 604,958                 |
| Lower Yazoo.....       | 206.30             | 185.20        | 53,271,514          | <sup>2</sup> 1,269,742        | <sup>3</sup> 584,059              | 1,853,801               |
| Upper Tensas.....      | <sup>4</sup> 240.5 | 191.3         | 54,062,474          | 1,387,144                     | 772,235                           | 2,159,379               |
| Lower Tensas.....      | 157.50             | 150.50        | 30,951,973          | 565,190                       | 355,482                           | 920,672                 |
| Atchafalaya.....       | 127.40             | 127.40        | 25,746,683          | 1,242,151                     | 896,723                           | 2,138,874               |
| Lafourche.....         | 82.30              | 82.30         | 12,634,839          | 1,151,532                     | 982,981                           | 2,134,513               |
| Barataria.....         | 71.15              | 71.15         | 4,792,433           | 154,834                       | 108,511                           | 263,345                 |
| Pontchartrain.....     | 125.35             | 125.35        | 22,425,506          | <sup>1</sup> 240,820          | 578,221                           | 1,819,041               |
| Lake Borgne.....       | 78.13              | 78.13         | 5,600,172           | 176,782                       | 167,863                           | 344,645                 |
| Total.....             | 1,612.63           | 1,508.33      | 316,614,462         | 10,224,361                    | 5,524,375                         | 15,748,736              |

<sup>1</sup> Miles above Cairo.

<sup>2</sup> 537,276 cubic yards Ashbrook Diike not included.

<sup>3</sup> 3,315 cubic yards in sublevees not included.

<sup>4</sup> 176.7 miles along Mississippi River and 63.8 miles along Arkansas River.

| Levee district.       | Lost or abandoned during the year. | Contents, 1918.     | Required to complete. | Estimated final contents. | Per cent now built. | Approximate area protected. |
|-----------------------|------------------------------------|---------------------|-----------------------|---------------------------|---------------------|-----------------------------|
|                       | <i>Cubic yards.</i>                | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cubic yards.</i>       |                     | <i>Sq. miles.</i>           |
| pper St. Francis..... | 7,259,058                          | 7,035,381           | 14,294,439            | 50.7                      | 700                 |                             |
| ower St. Francis..... | 45,514,256                         | 6,494,744           | 52,009,000            | 87.5                      | 3,500               |                             |
| hite River.....       | 16,869,955                         | 11,641,045          | 28,511,000            | 59.2                      | 910                 |                             |
| elfoot.....           | 2,888,715                          | 1,139,285           | 4,028,000             | 71.7                      | 310                 |                             |
| pper Yazoo.....       | 38,711,350                         | 2,920,650           | 41,632,000            | 93.0                      | 3,281               |                             |
| ower Yazoo.....       | 180,000                            | 54,945,315          | 32,099,460            | 87,044,777                | 63.1                | 3,367                       |
| pper Tensas.....      | 865,000                            | 55,356,853          | 82,008,310            | 83,365,163                | 66.4                | 2,675                       |
| ower Tensas.....      | 273,863                            | 31,598,782          | 14,026,192            | 45,624,974                | 69.3                | 2,080                       |
| chafalaya.....        | 761,214                            | 27,124,343          | 12,927,705            | 40,052,048                | 67.7                | 6,085                       |
| afourche.....         | 383,581                            | 14,385,771          | 2,871,285             | 17,257,056                | 83.4                | 2,020                       |
| arataria.....         | 125,067                            | 4,930,711           | 843,201               | 5,773,912                 | 85.4                |                             |
| ontchartrain.....     | 538,741                            | 23,705,806          | 8,463,358             | 32,169,164                | 73.7                | 1,816                       |
| ake Borgne.....       | 178,430                            | 5,766,387           | 626,369               | 6,392,756                 | 90.2                |                             |
| Total.....            | 3,305,896                          | 329,057,302         | 129,096,987           | 458,154,289               | 71.8                | 26,744                      |

The column "Estimated final contents" of the levees given above is based on grades as revised on April 19, 1914, and sections provisionally established by the commission.

The work above Cape Girardeau (restricted by law to levee construction) is summarized in the following table:

| Name of levee.                           | In system.    | Built.        | Contents, 1917.     | Built since by United States. | Built since by local authorities. | Total built since 1917. |
|------------------------------------------|---------------|---------------|---------------------|-------------------------------|-----------------------------------|-------------------------|
|                                          | <i>Miles.</i> | <i>Miles.</i> | <i>Cubic yards.</i> | <i>Cubic yards.</i>           | <i>Cubic yards.</i>               | <i>Cubic yards.</i>     |
| Duury drainage.....                      | 8             | 8             | 312,360             | .....                         | .....                             | .....                   |
| Muscataine Island.....                   | 13            | 13            | 222,000             | 42,250                        | .....                             | 42,250                  |
| Henderson County No. 1.....              | 8             | 8             | 850,000             | .....                         | .....                             | .....                   |
| Gregory.....                             | 5             | 5             | .....               | 40,285                        | 238,338                           | 278,623                 |
| Mont and Lima Lake.....                  | 11            | 4             | 1,014,000           | 116,876                       | .....                             | 116,876                 |
| Sny Island.....                          | 54            | 8             | 3,718,326           | 52,879                        | .....                             | 52,879                  |
| Riverland.....                           | 7             | 2.8           | 22,085              | 161,835                       | .....                             | 161,835                 |
| Elsberry.....                            | 11            | 11            | 562,000             | .....                         | .....                             | .....                   |
| East Side Levee and Sanitary.....        | 21            | 21            | 2,597,411           | 34,824                        | .....                             | 34,824                  |
| East Cape Girardeau and Clear Creek..... | 11            | 4             | 413,645             | 91,937                        | .....                             | 91,937                  |

| Name of levee.                           | Abandoned during year. | Contents, 1918.     | Required to complete. | Estimated final contents. | Per cent now built. | Approximate area protected. |
|------------------------------------------|------------------------|---------------------|-----------------------|---------------------------|---------------------|-----------------------------|
|                                          | <i>Cubic yards.</i>    | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cubic yards.</i>       |                     | <i>Acres.</i>               |
| Duury drainage.....                      | .....                  | 312,360             | 560,000               | 872,360                   | 35.8                | 5,300                       |
| Muscataine Island.....                   | 13,000                 | 251,250             | 490,000               | 741,250                   | 34.0                | 22,000                      |
| Henderson County No. 1.....              | .....                  | 850,000             | 135,000               | 985,000                   | 86.3                | 7,680                       |
| Gregory.....                             | .....                  | 278,623             | .....                 | 278,623                   | 100.0               | 8,000                       |
| Mont and Lima Lake.....                  | 48,000                 | 1,070,242           | 462,000               | 1,532,242                 | 70.0                | 29,500                      |
| Sny Island.....                          | .....                  | 3,771,205           | 1,950,000             | 5,721,205                 | 65.9                | 110,000                     |
| Riverland.....                           | .....                  | 183,920             | 496,080               | 680,000                   | 27.0                | 6,229                       |
| Elsberry.....                            | .....                  | 562,000             | .....                 | 562,000                   | 100.0               | 19,000                      |
| East Side Levee and Sanitary.....        | .....                  | 2,632,235           | .....                 | 2,632,235                 | 100.0               | 61,645                      |
| East Cape Girardeau and Clear Creek..... | 29,027                 | 476,555             | 287,760               | 764,315                   | 62.3                | 9,392                       |

Two types of levee machine have been constructed and purchased by the commission, and are in successful operation. In addition, several contractors have installed similar machines. As a result of this development of a suitable machine for levee construction, the amount of levee work that can be done annually is practically limited only by the amount of funds available therefor. (For details see Appendixes 3 and 4.)

There were no crevasses, no serious injuries to levees or revetments, no cut-offs, no overflowed areas outside the river banks, during the year.

#### CONDITION OF CHANNEL AT END OF FISCAL YEAR.

With the exception of periods of ice blockades and other rare periods of brief duration, there is now in the Mississippi River a good continuous navigable channel at all stages of the river and at all times of the year, with a depth of 9 feet or more and a width of at least 250 feet for a distance of 833 miles below Cairo, and a depth of no less than 30 feet with a width of several hundred feet at all times for the remaining 227 miles to the Head of Passes. This navigable channel is also of ample width and of at least 14 feet in depth from Cairo to the Gulf of Mexico during five to eight months of each year when high stages of river prevail.

The following are depths and widths for the different stretches of the river below Cairo that can usually be relied upon during the lowest stages of the year:

Cairo to Memphis, Tenn., 230 miles, least depth 9 feet for width of 250 feet. Low-water channel maintained by dredging.

Memphis to Vicksburg, Miss., 370 miles, least depth 9 feet for width of 250 feet. Low-water channel maintained by limited amount of dredging.

Vicksburg to Baton Rouge, La., 233 miles, least depth 11 feet for width of 250 feet or more. Low-water channel maintained by a limited amount of dredging at rare intervals.

Baton Rouge to New Orleans, La., 134 miles, least depth 35 feet for width of several hundred feet. No dredging.

New Orleans to Quarantine Station, La., 92 miles, least depth 62 feet for width of several hundred feet. No dredging.

At mean low water there is an available depth of  $31\frac{1}{2}$  feet to the Gulf through South Pass and 24 feet through Southwest Pass, as reported by the district engineer, New Orleans, La.

*Estimate of funds required.*—The flood control act provides "that not more than \$10,000,000 shall be expended therefor during any one fiscal year." The full amount can be profitably expended in the fiscal year ending June 30, 1920, provided it is made available by Congress prior to the commencement of such year, and exclusive of the balance unexpended July 1, 1919, all balances being needed at the end of each year as a reserve from which to pay outstanding liabilities, contract reserves, and to meet local contributions in the manner provided for by the flood-control act.

WM. H. BIXBY,  
*Brig. General, U. S. Army, Retired,*  
*President, Mississippi River Commission.*

J. A. OCKERSON,  
*Civil Engineer.*

HOMER P. RITTER,  
*Hydrographic and Geodetic Engineer,*  
*U. S. Coast and Geodetic Survey.*

J. G. WARREN,  
*Colonel, Corps of Engineers, United States Army.*

C. H. WEST,  
*Civil Engineer.*

LANSING H. BEACH,  
*Colonel, Corps of Engineers, United States Army.*

EDWARD A. GLENN.

*Money statements.*

## APPROPRIATIONS EXPENDED UNDER MISSISSIPPI RIVER COMMISSION.

*Appropriation for Mississippi River.*

|                                                                            |                       |
|----------------------------------------------------------------------------|-----------------------|
| July 1, 1917, balance unexpended.....                                      | \$3, 529, 369. 21     |
| Miscellaneous receipts from sales of Engineer property, rentals, etc. .... | 27, 425. 27           |
|                                                                            | <hr/> 3, 556, 794. 48 |
| June 30, 1918, amount expended during fiscal year.....                     | 2, 636, 514. 44       |
|                                                                            | <hr/> 920, 280. 04    |
| July 1, 1918, balance unexpended.....                                      |                       |
| July 1, 1918, outstanding liabilities.....                                 | \$186, 545. 75        |
| July 1, 1918, amount covered by uncompleted contracts .....                | 411, 041. 40          |
|                                                                            | <hr/> 597, 587. 15    |
| July 1, 1918, balance available.....                                       | 322, 692. 89          |
|                                                                            | <hr/> <hr/>           |
| Distributed as follows:                                                    |                       |
| Mississippi River Commission.....                                          | 509. 45               |
| Surveys, gauges and observations.....                                      | 122. 79               |

<sup>1</sup> The amount, \$3,518,003.72, reported in annual report for 1917, has been increased \$11,365.49, as follows:

## Increased by refundments—

## By the secretary—

November, 1917, voucher 151, March, 1917 (to surveys, gauges, and observations)..... \$1. 15

November, 1917, vouchers 1 and 4, March, 1917 (to dredges and dredging)..... 16. 01

## By the first and second districts officer—

August, 1917, correction in overpayment, by cancellation of check No. 2342, dated May 12, 1913 (to Reelfoot levee district)..... 48. 00

September, 1917, voucher in February, 1917 (to Barfield, Ark.)..... 1. 00

## By the third district officer—

July, 1917, voucher 124, February, 1917 (to Red Fork, Ark.)..... 3. 00

August, 1917, voucher 20, January, 1917 (to Cottonwood, Miss.)..... . 11

October, 1917, voucher 194, May, 1917 (to lower Yazoo levee district)..... 362. 83

December, 1917, voucher 157, June, 1917 (to upper Tensas levee district)..... 5. 00

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437. 10

Increased by reimbursement from St. Louis office for coal, credited to allotment for "dredges and dredging," secretary's office (ED 104197-723)..... 451. 28

Increased by reimbursement from United States Engineer office, Little Rock, Ark., for repairs to dredge *H. S. Taber*, credited to allotment for "dredges and dredging," secretary's office (ED 104197-1610)..... 1, 277. 87

Increased by reimbursement from St. Louis district office for coal, credited to allotment for "Gayoso Bend, Mo.," first and second districts..... 270. 00

Increased by reimbursement from appropriation "Pay, etc., of the Army" for expenditures pertaining to that appropriation, credited to allotment for "lower St. Francis levee district," first and second districts..... 283. 10

Increased by reimbursement from Quartermaster General for payment made on voucher 196, June, 1917, for pay and commutation, credited to allotment for "Reid-Bedford Bend, La.," third district..... 65. 56

Increased by reimbursements from United States Employees' Compensation Commission for treatment of injured employees, credited to allotments as follows, third district:

"Lower Yazoo levee district"..... 14. 00

"Vicksburg, Miss."..... 37. 00

"Repairs to existing works and stone"..... 25. 00

"Plant"..... 113. 80

Increased by reimbursement from appropriation "Pay, etc., of the Army" for pay and commutation of quarters credited to allotment for "Lower Tensas levee district," fourth district..... 298. 00

Increased by reimbursement from New Orleans, La., Engineer district for construction of barges, credited to allotment for "plant," fourth district (ED 69359-56 and 59)..... 8, 092. 78

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11, 365. 49

## 3474 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

|                                                                                    |                  |
|------------------------------------------------------------------------------------|------------------|
| Levees, Head of the Passes to Rock Island, Ill-----                                | 133,324.43       |
| Revetment and contraction works, permanent channel improvement and protection----- | 141,273.72       |
| Dredges and dredging-----                                                          | 33,823.43        |
| Plant and miscellaneous-----                                                       | 16,808.58        |
| Improving harbors and tributaries except Vicksburg Harbor-----                     | —3,169.51        |
|                                                                                    | <hr/> 322,692.89 |

## APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND HARBOR WORKS.

## July 1, 1917, balance unexpended:

|                                |                         |
|--------------------------------|-------------------------|
| Under act of Oct. 2, 1914----- | \$314,722.69            |
| Under act of Mar. 4, 1915----- | <sup>1</sup> 475,732.03 |

<sup>2</sup>\$790,454.72

## Miscellaneous receipts from sales of Engineer property:

|                                |        |
|--------------------------------|--------|
| Under act of Mar. 4, 1915----- | 102.55 |
|--------------------------------|--------|

---

790,557.27

## June 30, 1918, amount expended during fiscal year:

|                                |             |
|--------------------------------|-------------|
| Under act of Oct. 2, 1914----- | \$80,900.15 |
| Under act of Mar. 4, 1915----- | 211,747.69  |

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292,647.84

## July 1, 1918, balance unexpended:

|                                |            |
|--------------------------------|------------|
| Under act of Oct. 2, 1914----- | 233,822.54 |
| Under act of Mar. 4, 1915----- | 264,086.89 |

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497,909.43

## July 1, 1918, outstanding liabilities:

|                                |            |
|--------------------------------|------------|
| Under act of Mar. 4, 1915----- | 148,000.00 |
|--------------------------------|------------|

## July 1, 1918, amount covered by uncompleted contracts:

|                                |                  |
|--------------------------------|------------------|
| Under act of Oct. 2, 1914----- | \$232,185.26     |
| Under act of Mar. 4, 1915----- | 95,708.70        |
|                                | <hr/> 327,893.96 |

475,893.96

## July 1, 1918, balance available:

|                                |           |
|--------------------------------|-----------|
| Under act of Oct. 2, 1914----- | 1,637.28  |
| Under act of Mar. 4, 1915----- | 20,378.19 |

---

---

22,015.47

## Distributed as follows:

|                                                     |           |
|-----------------------------------------------------|-----------|
| Levees, Head of the Passes to Rock Island, Ill----- | 22,015.47 |
|-----------------------------------------------------|-----------|

<sup>1</sup>The amount, \$474,537.58, reported in annual report for 1917, has been increased \$1,194.45, as follows:

## Increased by refundments—

## By the secretary—

|                                                                          |        |
|--------------------------------------------------------------------------|--------|
| November, 1917, voucher 86, January, 1917 (to dredges and dredging)----- | \$0.09 |
|--------------------------------------------------------------------------|--------|

## By the first and second districts officer—

|                                                                                       |     |
|---------------------------------------------------------------------------------------|-----|
| September, 1917, voucher in February, 1917 (to lower St. Francis levee district)----- | .96 |
|---------------------------------------------------------------------------------------|-----|

---

1.05

Increased by reimbursement from Little River drainage district for expenditures in that district, credited to allotment for "upper St. Francis levee district," first and second districts-----

995.34

Increased by reimbursement from appropriation "Pay, etc., of the Army" for expenditures pertaining to appropriation named, credited to allotment for "upper St. Francis levee district," first and second districts-----

183.06

Increased by appropriation reimbursement for expenditure in March, 1917, on work at Star Landing, Miss., credited to allotment for "general repairs, and stone," first and second districts-----

15.00

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1,194.45<sup>2</sup>The amount, \$789,260.27, reported in annual report for 1917, has been increased \$1,194.45 by refundments, etc., as shown in footnote <sup>2</sup> above.

APPROPRIATION FOR GAUGING WATERS OF THE MISSISSIPPI RIVER AND ITS  
TRIBUTARIES.<sup>1</sup>

|                                                                                                                                                                                                              |            |                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------|
| July 1, 1917, balance unexpended.....                                                                                                                                                                        |            | <sup>2</sup> \$1,776.36 |
| Amount allotted by Chief of Engineers, from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902..... |            | 9,100.00                |
|                                                                                                                                                                                                              |            | <hr/> 10,876.36         |
| June 30, 1918, amount expended during fiscal year.....                                                                                                                                                       | \$8,217.85 |                         |
| June 30, 1918, amount reverted to Treasury during fiscal year.....                                                                                                                                           | 860.84     |                         |
|                                                                                                                                                                                                              |            | <hr/> 9,078.69          |
| July 1, 1918, balance unexpended.....                                                                                                                                                                        |            | 1,797.67                |
| July 1, 1918, outstanding liabilities.....                                                                                                                                                                   |            | 1,797.67                |
|                                                                                                                                                                                                              |            | <hr/> 0.00              |
| Amount that can be profitably expended in fiscal year ending June 30, 1920.....                                                                                                                              |            | <hr/> <hr/> 9,100.00    |

FINANCIALLY ADJUSTED STATEMENT OF EXPENDITURES DURING THE FISCAL YEAR ENDING JUNE 30, 1918, SUBMITTED IN COMPLIANCE WITH REQUIREMENT OF SECTION 6 OF RIVER AND HARBOR ACT OF AUGUST 11, 1888.

## Observations:

|                                                                                            |            |                      |
|--------------------------------------------------------------------------------------------|------------|----------------------|
| Pay of permanent gauge observers.....                                                      |            | \$3,548.00           |
| Inspections and repairs:                                                                   |            |                      |
| Inspection of gauges on Mississippi River by junior engineers and parties on steamers..... | \$1,877.93 |                      |
| Inspection of gauges on tributaries.....                                                   | 109.41     |                      |
| Renewals and repairs of gauges and bulletins.....                                          | 93.70      |                      |
|                                                                                            |            | <hr/> 2,081.04       |
| Office expenses and contingencies:                                                         |            |                      |
| Pay of assistant and junior engineers, surveyors, and clerks.....                          | 1,980.23   |                      |
| Stationery, printing, office rent, etc.....                                                | 608.58     |                      |
|                                                                                            |            | <hr/> 2,588.81       |
| Total.....                                                                                 |            | <hr/> <hr/> 8,217.85 |

## APPROPRIATION FOR FLOOD CONTROL, MISSISSIPPI RIVER, AND SACRAMENTO RIVER, CAL.

|                                                                                            |              |                          |
|--------------------------------------------------------------------------------------------|--------------|--------------------------|
| July 1, 1917, balance unexpended.....                                                      |              | \$5,660,000.00           |
| Miscellaneous receipts from sales of blue prints, rentals, depreciation of plant, etc..... |              | 7,885.77                 |
|                                                                                            |              | <hr/> 5,667,885.77       |
| June 30, 1918, amount expended during fiscal year.....                                     |              | 2,774,299.65             |
|                                                                                            |              | <hr/> 2,893,586.12       |
| July 1, 1918, balance unexpended.....                                                      |              | 2,893,586.12             |
| July 1, 1918, outstanding liabilities.....                                                 | \$469,008.10 |                          |
| July 1, 1918, amount covered by uncompleted contracts.....                                 | 1,218,735.36 |                          |
|                                                                                            |              | <hr/> 1,687,743.46       |
| July 1, 1918, balance available.....                                                       |              | <hr/> <hr/> 1,205,842.66 |

The custody and care of the gauges maintained under this appropriation were assumed by the Mississippi River Commission Feb. 11, 1901, on which date they were transferred to the secretary, under authority of Secretary of War, dated Jan. 25, 1901. The amount, \$1,771.69, reported in annual report for 1917, has been increased \$4.67 by the secretary, by refundment of overpayment on voucher 107, June, 1917.

## Distributed as follows:

|                                                                                         |             |                   |
|-----------------------------------------------------------------------------------------|-------------|-------------------|
| Mississippi River Commission-----                                                       | \$11,728.02 |                   |
| Surveys, gauges, and observations-----                                                  | 10,256.29   |                   |
| Levees, Head of the Passes to Rock Island, Ill-----                                     | 288,803.72  |                   |
| Revetment and contraction works, permanent chan-<br>nel improvement and protection----- | 321,711.25  |                   |
| Dredges and dredging-----                                                               | 100,753.61  |                   |
| Plant and miscellaneous-----                                                            | 318,901.25  |                   |
| Improving harbors and tributaries except Memphis<br>Harbor-----                         | 115,661.84  |                   |
| Improving Memphis Harbor-----                                                           | 38,026.68   |                   |
|                                                                                         |             | <u>1,205,842.</u> |

## AMOUNT THAT CAN BE PROFITABLY EXPENDED IN FISCAL YEAR ENDING JUNE 30, 1920.

The flood-control act provides "that not more than \$10,000,000 shall be expended therefor during any one fiscal year. The full amount can be profitably expended in the fiscal year ending June 30, 1920, exclusive of the balance unexpended July 1, 1919.

## CONTRIBUTED FUNDS.

|                                                                               |             |                 |
|-------------------------------------------------------------------------------|-------------|-----------------|
| For improvement of Mississippi River in upper St. Francis levee district----- |             | \$234,000.      |
| June 30, 1918, expended to end of last fiscal year---                         | \$26,734.69 |                 |
| June 30, 1918, expended during fiscal year-----                               | 78,919.31   |                 |
| July 1, 1918, amount covered by uncompleted con-<br>tracts-----               | 128,346.00  |                 |
|                                                                               |             | <u>234,000.</u> |

|                                                            |         |
|------------------------------------------------------------|---------|
| For improvement of Mississippi River at Norfolk, Miss----- | 50,000. |
| June 30, 1918, expended during fiscal year-----            | 50,000. |

## FUNDS CONTRIBUTED BY LOCAL LEVEE DISTRICTS FOR FLOOD CONTROL, MISSISSIPPI RIVER, IN ACCORDANCE WITH SUNDEY CIVIL ACT, JUNE 12, 1917.

|                                                                 |                 |
|-----------------------------------------------------------------|-----------------|
| For levees, Head of Passes to Rock Island, Ill-----             | \$1,373,201.    |
| June 30, 1918, amount expended during fiscal year-----          | 278,264.        |
| July 1, 1918, balance unexpended-----                           | 1,094,937.      |
| July 1, 1918, outstanding liabilities-----                      | \$76,400.14     |
| July 1, 1918, amount covered by uncompleted con-<br>tracts----- | 885,955.48      |
|                                                                 | <u>962,355.</u> |
| July 1, 1918, balance available-----                            | 132,581.        |

## CONSOLIDATED STATEMENT OF ALL APPROPRIATIONS EXPENDED UNDER THE MISSISSIPPI RIVER COMMISSION TO JUNE 30, 1918.

## APPROPRIATION FOR MISSISSIPPI RIVER.

|                                             |            |
|---------------------------------------------|------------|
| Act of June 28, 1879 (organic)-----         | \$175,000. |
| Act of June 16, 1880 (sundry civil)-----    | 150,000.   |
| Act of Mar. 3, 1881 (river and harbor)----- | 1,000,000. |
| Act of Mar. 3, 1881 (sundry civil)-----     | 150,000.   |
| Act of Aug. 2, 1882 (river and harbor)----- | 4,123,000. |
| Act of Aug. 7, 1882 (sundry civil)-----     | 150,000.   |
| Act of Mar. 3, 1883 (sundry civil)-----     | 150,000.   |
| Act of Jan. 19, 1884-----                   | 1,000,000. |
| Act of July 5, 1884 (river and harbor)----- | 75,000.    |

|                                                                                                                                                                                                                                                                                                  |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| ct of July 5, 1884 (river and harbor), less \$5,000 transferred to snag-boat service                                                                                                                                                                                                             | \$2,065,000.00 |
| ct of July 7, 1884 (sundry civil)                                                                                                                                                                                                                                                                | 75,000.00      |
| ct of Aug. 5, 1886 (river and harbor), less \$5,942.60 for expenses, Office Chief of Engineers                                                                                                                                                                                                   | 1,994,057.40   |
| ct of Aug. 5, 1886 (river and harbor), less \$47.30 for expenses, Office Chief of Engineers                                                                                                                                                                                                      | 29,952.70      |
| ct of Aug. 11, 1888 (rivers and harbor), less \$4,859 for expenses, Office Chief of Engineers                                                                                                                                                                                                    | 2,840,141.00   |
| ct of Aug. 11, 1888 (river and harbor)                                                                                                                                                                                                                                                           | 75,000.00      |
| ct of Oct. 2, 1888 (sundry civil)                                                                                                                                                                                                                                                                | 35,000.00      |
| ct of Oct. 19, 1888 (deficiency), less \$4,214.39 reverted to the Treasury                                                                                                                                                                                                                       | 20,785.61      |
| ct of Sept. 19, 1890 (river and harbor)                                                                                                                                                                                                                                                          | 3,200,000.00   |
| ct of Sept. 30, 1890 (deficiency)                                                                                                                                                                                                                                                                | 5,625.00       |
| ct of Mar. 3, 1891 (deficiency)                                                                                                                                                                                                                                                                  | 1,950.00       |
| Joint resolution approved Mar. 3, 1891 (Public, No. 19)                                                                                                                                                                                                                                          | 1,000,000.00   |
| ct of July 13, 1892 (river and harbor)                                                                                                                                                                                                                                                           | 2,470,000.00   |
| ct of July 28, 1892 (deficiency)                                                                                                                                                                                                                                                                 | 44.80          |
| ct of Mar. 3, 1893 (sundry civil)                                                                                                                                                                                                                                                                | 2,665,000.00   |
| ct of Aug. 18, 1894 (river and harbor)                                                                                                                                                                                                                                                           | 485,000.00     |
| ct of Aug. 18, 1894 (sundry civil)                                                                                                                                                                                                                                                               | 2,665,000.00   |
| ct of Mar. 2, 1895 (sundry civil)                                                                                                                                                                                                                                                                | 2,665,000.00   |
| ct of June 3, 1896 (river and harbor)                                                                                                                                                                                                                                                            | 909,000.00     |
| Joint resolution approved Mar. 31, 1897 (Public, No. 6)                                                                                                                                                                                                                                          | 250,000.00     |
| ct of June 4, 1897 (sundry civil)                                                                                                                                                                                                                                                                | 2,933,333.00   |
| ct of July 19, 1897 (deficiency)                                                                                                                                                                                                                                                                 | 625,000.00     |
| ct of July 1, 1898 (sundry civil)                                                                                                                                                                                                                                                                | 1,983,333.00   |
| ct of Mar. 3, 1899 (sundry civil)                                                                                                                                                                                                                                                                | 2,583,333.00   |
| ct of Mar. 3, 1899 (river and harbor)                                                                                                                                                                                                                                                            | 185,000.00     |
| ct of June 6, 1900 (sundry civil), less \$5,000 for expenses, Office Chief of Engineers                                                                                                                                                                                                          | 2,245,000.00   |
| ct of June 13, 1902 (river and harbor)                                                                                                                                                                                                                                                           | 2,200,000.00   |
| ct of Mar. 3, 1903 (sundry civil)                                                                                                                                                                                                                                                                | 2,000,000.00   |
| ct of Apr. 28, 1904 (sundry civil)                                                                                                                                                                                                                                                               | 2,000,000.00   |
| ct of Mar. 3, 1905 (river and harbor)                                                                                                                                                                                                                                                            | 1,000,000.00   |
| ct of Mar. 3, 1905 (sundry civil)                                                                                                                                                                                                                                                                | 2,000,000.00   |
| ct of June 30, 1906 (sundry civil)                                                                                                                                                                                                                                                               | 2,000,000.00   |
| ct of Mar. 2, 1907 (river and harbor)                                                                                                                                                                                                                                                            | 3,000,000.00   |
| ct of May 27, 1908 (sundry civil)                                                                                                                                                                                                                                                                | 2,000,000.00   |
| ct of Mar. 4, 1909 (sundry civil)                                                                                                                                                                                                                                                                | 2,000,000.00   |
| ct of June 25, 1910 (sundry civil)                                                                                                                                                                                                                                                               | 2,000,000.00   |
| ct of June 25, 1910 (river and harbor)                                                                                                                                                                                                                                                           | 2,000,000.00   |
| ct of Feb. 27, 1911 (river and harbor)                                                                                                                                                                                                                                                           | 3,000,000.00   |
| ct of July 25, 1912 (river and harbor), less \$1,443,944.83 expended for rebuilding levees, under joint resolution of Apr. 30, 1912                                                                                                                                                              | 4,556,055.17   |
| Act of July 25, 1912 (river and harbor)                                                                                                                                                                                                                                                          | 30,000.00      |
| Act of Mar. 4, 1913 (river and harbor)                                                                                                                                                                                                                                                           | 6,000,000.00   |
| Act of Mar. 4, 1913 (river and harbor)                                                                                                                                                                                                                                                           | 200,000.00     |
| Act of July 27, 1916 (river and harbor)                                                                                                                                                                                                                                                          | 6,000,000.00   |
| Total specific appropriations                                                                                                                                                                                                                                                                    | 82,965,610.68  |
| Balances from former appropriations applied to works below Cairo under act of Aug. 2, 1882, less \$123.42 reverted to Treasury                                                                                                                                                                   | \$272,504.96   |
| Same for works above Cairo, under act of July 5, 1884                                                                                                                                                                                                                                            | 22,632.53      |
| Total balances                                                                                                                                                                                                                                                                                   | 295,137.49     |
| Amount, \$15.76, arising from refundments pertaining to extinct or unknown allotments, less debit of Treasury settlement No. 13704, Dec. 26, 1900, as reported by the Chief of Engineers, U. S. Army, June 23, 1916, and credited to allotment for "Mississippi River Commission" December, 1916 | 14.02          |

## Miscellaneous receipts:

|                                                                                                                                                                                                                                                 |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Previously reported-----                                                                                                                                                                                                                        | \$160, 210. 35 |
| Amounts received from sales of Engineer property and stores, under the provisions of section 5 of river and harbor act of June 13, 1902, and sales of contact prints—                                                                           |                |
| By the secretary—                                                                                                                                                                                                                               |                |
| From sale of coal to Chicago & Eastern Illinois R. R., credited in June, 1918, to allotment for "Dredges and dredging"-----                                                                                                                     | 271. 19        |
| By first and second districts officer—                                                                                                                                                                                                          |                |
| From sales of blue prints, in July, 1917, credited to allotment for "Lower St. Francis levee district"-----                                                                                                                                     | . 70           |
| From sale of Engineer property in March, 1918, credited to allotment for "Plant"-----                                                                                                                                                           | 300. 00        |
| By third district officer—                                                                                                                                                                                                                      |                |
| From sale of Engineer property, credited to allotment for "Plant" in December, 1917-----                                                                                                                                                        | 2, 674. 15     |
| By fourth district officer—                                                                                                                                                                                                                     |                |
| From sale of Engineer property in July, 1917, credited to allotment for "Plant"-----                                                                                                                                                            | 2, 908. 69     |
| Amount received in December, 1917, for rental of steamboat <i>Nokomis</i> (ED 114290-3, sec. MRC 2438-11) credited to allotment for "Dredges and dredging," secretary's office----                                                              | 1, 220. 00     |
| Amount received in January, 1918, for rental of steamboats <i>Nokomis</i> and <i>Sachem</i> (ED 114290-3, sec. MRC 2438-11) credited to allotment for "Dredges and dredging," secretary's office-----                                           | 2, 260. 00     |
| Amount received in April, 1918, for rental of steamboat <i>Leota</i> (sec. MRC 2557-12) credited to allotment for "Dredges and dredging," secretary's office-----                                                                               | 805. 00        |
| Amount received in May, 1918, for rental of steamboat <i>Leota</i> (ED 93650-23, sec. MRC 2557-12) credited to allotment for "Dredges and dredging," secretary's office-----                                                                    | 910. 00        |
| Amount received in May, 1918, for docking steamer <i>Eclipse</i> (ED 78130-29, sec. MRC 2045-29) credited to allotment for "Dredges and dredging," secretary's office-----                                                                      | 842. 90        |
| Amount received in May, 1918, from collection of stoppage against pay of a United States employee for destruction of public property, credited to allotment for "Dredges and dredging," secretary's office-----                                 | 19. 33         |
| Amount received in June, 1918, for rental of dredge <i>Delta</i> , steamboats <i>Leota</i> and <i>Saturn</i> and pilesinker No. 983 (ED 104197-2251, sec. MRC 1615-70) credited to allotment for "Dredges and dredging," secretary's office---- | 3, 628. 76     |
| Amount received in June, 1918, for rental of barges, credited to allotment for "Plant," first and second districts-----                                                                                                                         | 1, 144. 66     |
| Amount received in February, 1918, for use of plant by the Pine Bluff & Rosedale Packet Co. (ED 117483) credited to allotment for "Plant," third district-----                                                                                  | 121. 28        |
| Amount received in February, 1918, for use of plant by the Thane Lumber Co. (ED 117483-2) credited to allotment for "Plant" third district-----                                                                                                 | 182. 96        |

## Miscellaneous receipts—Continued.

|                                                                                                                                                                                                |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Amount received in March, 1918, for rental of dock to Vicksburg & Delta Ferry Co. (ED 117483-6) credited to allotment for "Plant" third district-----                                          | \$390.00      |
| Amount received in March, 1918, for use of towboat credited to allotment for "Plant" third district-----                                                                                       | 134.75        |
| Amount received in April, 1918, for use of towboat and barges by Board Mississippi Levee Commissioners (ED 117483-9) credited to allotment for "Plant" third district-----                     | 425.43        |
| Amount received in May, 1918, for rental of plant by the Royal Route Co. (ED 117483-5) credited to allotment for "Plant" third district-----                                                   | 1,890.09      |
| Amount received in June, 1918, for rental of plant, from New Orleans, La., district, credited to allotment for "Plant" third district-----                                                     | 2,923.72      |
| Amount received in June, 1918, for rental of plant, from Vicksburg, Miss., district, credited to allotment for "Plant" third district-----                                                     | 702.59        |
| Amount received in June, 1918, for rental of plant, from Fourth Mississippi River Commission district, credited to allotment for "Plant" third district-----                                   | 130.00        |
| Amount received in September, 1917, for rental of steel-carrying barge (ED 74811-55) credited to allotment for "Pontchartrain levee district" fourth district-----                             | 172.50        |
| Amount received in February, 1918, for wear and tear of plant account docking tug <i>Uacha</i> , credited to allotment for "Plant" fourth district-----                                        | 15.02         |
| Amount received in March, 1918, from rental of levee machine barge (ED 74811-57) credited to allotment for "Pontchartrain levee district" fourth district-----                                 | 648.33        |
| Amount received in March, 1918, for wear and tear of plant constructing barges for New Orleans, La., Engineer district, credited to allotment for "Plant" fourth district-----                 | 1,547.01      |
| Amount received in May, 1918, for rental of barges (ED 74811-60 and 63) credited to allotment for "Pontchartrain levee district" fourth district-----                                          | 586.04        |
| Amount received in May, 1918, for rental of barges (ED 74811-59 and 62 and 93650-21) credited to allotment for "Plant" fourth district-----                                                    | 186.00        |
| Amount received in June, 1918, for rental of levee machine barge (ED 93650-24) credited to allotment for "Pontchartrain levee district" fourth district-----                                   | 333.97        |
| Amount received in June, 1918, for wear and tear of plant in building barge for Panama Canal (ED 91263-376) credited to allotment for "Plant" fourth district-----                             | 37.90         |
| Amount received in June, 1918, for wear and tear of plant in building barge for first New Orleans, La., Engineer district (ED 96661-32) credited to allotment for "Plant" fourth district----- | 12.30         |
| Total miscellaneous receipts-----                                                                                                                                                              | \$187,635.62  |
| Total-----                                                                                                                                                                                     | 83,448,397.81 |

*Expended.*

| Location and object.                                                                   | To June 30, 1917.          | During year ending June 30, 1918. | Total.         |
|----------------------------------------------------------------------------------------|----------------------------|-----------------------------------|----------------|
| Mississippi River Commission.....                                                      | \$1,081,751.47             | \$15,864.41                       | \$1,097,615.88 |
| Surveys, gauges, and observations.....                                                 | 3,081,594.67               | 16,539.20                         | 3,098,133.87   |
| Examination from Cape Girardeau, Mo., to Rock Island, Ill.....                         | 10,000.00                  |                                   | 10,000.00      |
| Levees, Head of the Passes, to Rock Island, Ill.....                                   | <sup>2</sup> 33,046,682.17 | 1,235,376.85                      | 34,282,059.02  |
| Revetment and contraction works, permanent channel improvement and protection.....     | <sup>3</sup> 18,395,625.92 | 779,574.26                        | 19,175,200.18  |
| Dredges and dredging.....                                                              | <sup>4</sup> 6,888,225.64  | 158,603.86                        | 7,046,829.50   |
| Experimental dikes.....                                                                | 100,000.00                 |                                   | 100,000.00     |
| Plant and miscellaneous.....                                                           | <sup>5</sup> 6,449,981.22  | 292,152.71                        | 6,742,133.93   |
| Improving harbors and tributaries, except Vicksburg Harbor.....                        | <sup>6</sup> 9,417,206.37  | 108,325.51                        | 9,525,531.88   |
| Improving Vicksburg Harbor.....                                                        | <sup>6</sup> 652,903.34    | 30,077.64                         | 682,980.98     |
| Examination and survey of lands subject to overflow, east bank, Mississippi River..... | 22,401.94                  |                                   | 22,401.94      |
| Works above Cairo.....                                                                 | 737,632.53                 |                                   | 737,632.53     |
| Total expended.....                                                                    | 79,884,005.27              | 2,636,514.44                      | 82,520,519.71  |
| To surplus fund.....                                                                   |                            |                                   | 77,598.06      |
| Balance unexpended June 30, 1918.....                                                  |                            |                                   | 920,280.04     |
| Total.....                                                                             |                            |                                   | 83,448,397.81  |

<sup>1</sup> The amount, \$3,081,595.82, reported in annual report for 1917, has been decreased \$1.15 by refundment of overpayment by the secretary on voucher 151, March, 1917 (to surveys, gauges and observations).

<sup>2</sup> The amount, \$33,047,693.10, reported in annual report for 1917, has been decreased \$1,010.93, by refundments of overpayments and reimbursements, as follows:

|                                                                                                                        |          |
|------------------------------------------------------------------------------------------------------------------------|----------|
| By the first and second districts officer—                                                                             |          |
| August, 1917, cancellation of check No. 2342 (to Reelfoot levee district).....                                         | \$48.00  |
| November, 1917, reimbursement from appropriation "Pay, etc., of the Army" (to lower St. Francis levee district).....   | 283.10   |
| By the third district officer—                                                                                         |          |
| October, 1917, voucher 194, May, 1917 (to Lower Yazoo levee district).....                                             | 362.83   |
| December, 1917, voucher 157, June, 1917 (to upper Tensas levee district).....                                          | 5.00     |
| January, 1918, reimbursement from United States Employees Compensation Commission (to lower Yazoo levee district)..... | 14.00    |
| By the fourth district officer—                                                                                        |          |
| November, 1917, reimbursement from appropriation "Pay, etc., of the Army" (to lower Tensas levee district).....        | 298.00   |
|                                                                                                                        | 1,010.93 |

<sup>3</sup> The amount, \$18,395,990.59, reported in annual report for 1917, has been decreased \$364.67 by refundments of overpayments and reimbursements, as follows:

|                                                                                                                                                           |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| By the first and second districts officer—                                                                                                                |        |
| September, 1917, voucher in February, 1917 (to Barfield, Ark.).....                                                                                       | \$1.00 |
| July, 1917, reimbursement by St. Louis district office for coal furnished snag boats (to Gayoso Bend, Mo.).....                                           | 270.00 |
| By third district officer—                                                                                                                                |        |
| July, 1917, voucher 124, February, 1917 (to Red Fork, Ark.).....                                                                                          | 3.00   |
| August, 1917, voucher 20, January, 1917 (to Cottonwood, Miss.).....                                                                                       | .11    |
| November, 1917, reimbursement from Quartermaster General for payment made on voucher 196, June, 1917, for pay and commutation (to Reid-Bedford, La.)..... | 65.56  |
| January, 1918, reimbursement from United States Employees Compensation Commission, for treatment of injured employees (to Red Fork, Ark.).....            | 25.00  |
|                                                                                                                                                           | 364.67 |

<sup>4</sup> The amount, \$6,889,970.80, reported in annual report for 1917, has been decreased \$1,745.16 by refundment of overpayments and reimbursements by the secretary, as follows:

|                                                                                                                                                         |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| November, 1917, vouchers 1 and 4, March 1917 (to dredges and dredging).....                                                                             | \$16.01  |
| July, 1917, reimbursement from St. Louis district office for coal furnished snag boats (to dredge and dredging).....                                    | 451.28   |
| March, 1918, reimbursement from U. S. Engineer office, Little Rock, Ark., for repairs, etc., to U. S. dredge H. S. Taber (to dredges and dredging)..... | 1,277.87 |
|                                                                                                                                                         | 1,745.16 |

<sup>5</sup> The amount, \$6,458,187.80, reported in annual report for 1917, has been decreased \$8,206.58 by reimbursements, as follows:

|                                                                                                                                       |          |
|---------------------------------------------------------------------------------------------------------------------------------------|----------|
| By the third district officer—                                                                                                        |          |
| January, 1918, reimbursement from United States Employees Compensation Commission, for treatment of injured employees (to plant)..... | \$113.80 |
| By the fourth district officer—                                                                                                       |          |
| April, 1918, reimbursement from New Orleans, La., Engineer district, for construction of barges (to plant).....                       | 8,092.78 |
|                                                                                                                                       | 8,206.58 |

<sup>6</sup> The amount, \$652,940.34, reported in annual report for 1917, has been decreased \$37 by reimbursement by the third district officer, as follows:

|                                                                                                                                                  |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| January, 1918, reimbursement from United States Employees Compensation Commission, for treatment of injured employees (to Vicksburg, Miss.)..... | \$37. |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------|

<sup>7</sup> Unexpended balance of the specific appropriation by act of July 25, 1912, for examination and survey of lands subject to overflow, east bank, Mississippi River, carried to surplus fund June 30, 1914. (ED 15927-414, sec. MRC 2000-1.)

APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND  
HARBOR WORKS.

of Oct. 2, 1914 (allotment Oct. 7, 1914)----- \$3, 750, 000. 00  
of Mar. 4, 1915 (allotment Apr. 2, 1915)----- 4, 000, 000. 00

Total specific appropriations----- 7, 750, 000. 00

Miscellaneous receipts:

Previously reported----- \$11, 403. 18

Accounts received from sales of Engineer property  
under provisions of section 5, of river and harbor  
act of June 13, 1902:

By first and second districts officer—

From sale of condemned engineer property,  
credited in July, 1917, to allotment for  
"White River levee district" act of Mar. 4,  
1915-----

102. 55

Total miscellaneous receipts----- 11, 505. 73

Total----- 7,761, 505. 73

Expended.

| Location and object.                                                                     | To June 30,<br>1917. | During year<br>ending<br>June 30, 1918. | Total.          |
|------------------------------------------------------------------------------------------|----------------------|-----------------------------------------|-----------------|
| Mississippi River Commission.....                                                        | \$69, 751. 29        |                                         | \$69, 751. 29   |
| Surveys, gages, and observations.....                                                    | 121, 740. 09         | \$2, 671. 76                            | 124, 411. 85    |
| Lees, Head of the Passes to Cape Girardeau, Mo.....                                      | 13, 106, 128. 12     | 221, 808. 82                            | 3, 327, 936. 94 |
| Settlement and contraction works, permanent channel im-<br>provement and protection..... | 2, 157, 214. 71      | 28, 136. 60                             | 2, 185, 351. 31 |
| Dredging.....                                                                            | 3 605, 662. 06       |                                         | 605, 662. 06    |
| Experimental revetment.....                                                              | 32, 670. 73          | 30. 66                                  | 32, 701. 39     |
| Land and miscellaneous.....                                                              | 556, 109. 57         | 15, 000. 00                             | 571, 109. 57    |
| Improving harbors and tributaries, except Vicksburg Harbor.                              | 321, 671. 89         | 25, 000. 00                             | 346, 671. 89    |
| Total expended.....                                                                      | 6, 970, 948. 46      | 292, 647. 84                            | 7, 263, 596. 30 |
| Balance unexpended June 30, 1918.....                                                    |                      |                                         | 497, 909. 43    |
| Total appropriated, etc.....                                                             |                      |                                         | 7, 761, 505. 73 |

The amount, \$3,107,307.48, reported in annual report for 1917, has been decreased \$1,179.36 by refundment  
overpayment and reimbursements by the first and second district officer, as follows:

November, 1917, voucher in February, 1917 (to lower St. Francis Levee district)..... \$0.96  
November, 1917, reimbursement from Little River drainage district for expenditures in that district  
(to upper St. Francis Levee district)..... 995.34  
November, 1917, reimbursement from appropriation "Pay, etc., of the Army," for expenditures  
pertaining to that appropriation..... 183.06

1, 179. 36

The amount, \$2,157,229.71, reported in annual report for 1917, has been decreased \$15 by the first and  
second districts officer account appropriation reimbursement in December, 1917, for expenditure in March,  
1917, on work at Star Landing, Miss. (to general repairs and stone).

The amount, \$605,662.15, reported in annual report for 1917, has been decreased \$0.09 by refundment  
overpayment by the secretary, November, 1917, voucher 86, January, 1917 (to dredges and dredging).

Appropriation for gauging waters of the Mississippi River and its tributaries.

Allotments from general appropriations for examinations, surveys,  
and contingencies of rivers and harbors by acts of—

Mar. 3, 1871 (allotment Apr. 11, 1871)----- \$5, 000. 00

June 10, 1872 (allotment July 11, 1872)----- 5, 000. 00

Mar. 3, 1873 (allotment May 17, 1873)----- 5, 000. 00

June 23, 1874 (allotment July 29, 1874)----- 5, 000. 00

Mar. 3, 1875 (allotment Mar. 22, 1875)----- 5, 000. 00

Specific appropriations by river and harbor acts of—

Aug. 14, 1876----- 5, 000. 00

June 18, 1878----- 5, 000. 00

Mar. 3, 1879----- 5, 000. 00

June 14, 1880----- 5, 000. 00

Mar. 3, 1881----- 5, 000. 00

Aug. 2, 1882----- 5, 000. 00

|                                                                                                                                                                                                     |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Deficiency act of Mar. 12, 1884                                                                                                                                                                     | \$2, 10  |
| Specific appropriations by river and harbor acts of—                                                                                                                                                |          |
| July 5, 1884                                                                                                                                                                                        | 5, 00    |
| Aug. 5, 1886                                                                                                                                                                                        | 5, 00    |
| Allotted from specific appropriation by river and harbor act of Aug. 11, 1888 (allotment Oct. 17, 1888)                                                                                             | 8, 70    |
| Deficiency act of Oct. 19, 1888                                                                                                                                                                     | 3, 60    |
| Allotments from permanent indefinite appropriation made by section 6 of river and harbor act of Aug. 11, 1888, for fiscal years, viz:                                                               |          |
| 1890 (allotment Aug. 23, 1889)                                                                                                                                                                      | 9, 00    |
| 1891 (allotment Aug. 19, 1890, \$8,700, less \$3,518.34 withheld in United States Treasury under ruling that only \$6,000 can be expended each fiscal year)                                         | 5, 18    |
| 1892 (allotment July 17, 1891)                                                                                                                                                                      | 5, 100   |
| 1893 (allotment July 15, 1892)                                                                                                                                                                      | 5, 500   |
| 1894 (allotment July 18, 1893)                                                                                                                                                                      | 5, 500   |
| 1895 (allotment June 5, 1894)                                                                                                                                                                       | 5, 500   |
| 1896 (allotment June 4, 1895)                                                                                                                                                                       | 5, 500   |
| 1897 (allotment May 13, 1896)                                                                                                                                                                       | 5, 500   |
| 1898 (allotment June 16, 1897)                                                                                                                                                                      | 5, 500   |
| 1899 (allotments May 27, 1898, \$5,500, July 12, 1898, \$500)                                                                                                                                       | 6, 000   |
| 1900 (allotment June 1, 1899)                                                                                                                                                                       | 5, 500   |
| 1901 (allotment July 2, 1900)                                                                                                                                                                       | 6, 000   |
| 1902 (allotment July 31, 1901)                                                                                                                                                                      | 6, 000   |
| Allotments from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902, for fiscal years, viz: |          |
| 1903 (allotment July 23, 1902, \$9,600, less \$500 allotted Aug. 2, 1902, to St. Paul, Minn., district)                                                                                             | 9, 100   |
| 1904 (allotment Apr. 18, 1903)                                                                                                                                                                      | 9, 100   |
| 1905 (allotment Aug. 11, 1904)                                                                                                                                                                      | 9, 100   |
| 1906 (allotment June 30, 1905)                                                                                                                                                                      | 9, 100   |
| 1907 (allotment July 2, 1906)                                                                                                                                                                       | 9, 100   |
| 1908 (allotment July 24, 1907)                                                                                                                                                                      | 9, 100   |
| 1909 (allotment July 3, 1908)                                                                                                                                                                       | 9, 100   |
| 1910 (allotment July 13, 1909)                                                                                                                                                                      | 9, 100   |
| 1911 (allotment July 27, 1910)                                                                                                                                                                      | 9, 600   |
| 1912 (allotment Feb. 7, 1911)                                                                                                                                                                       | 9, 100   |
| 1913 (allotment May 29, 1912)                                                                                                                                                                       | 9, 100   |
| 1914                                                                                                                                                                                                | 9, 100   |
| 1915 (allotment Sept. 2, 1914)                                                                                                                                                                      | 9, 100   |
| 1916 (allotment July 28, 1915)                                                                                                                                                                      | 9, 100   |
| 1917 (allotment Aug. 3, 1916)                                                                                                                                                                       | 9, 100   |
| 1918 (allotment June 27, 1917)                                                                                                                                                                      | 9, 100   |
| Total                                                                                                                                                                                               | 301, 281 |

*Expended.*

|                                          | To June 30,<br>1917.      | During year<br>ending<br>June 30, 1918. | Total        |
|------------------------------------------|---------------------------|-----------------------------------------|--------------|
| Expenditures                             | <sup>1</sup> \$272,306.36 | \$8,217.85                              | \$280,524.21 |
| Unexpended balances reverted to Treasury | 18,098.94                 | 860.84                                  | 18,959.78    |
| Total                                    | 290,405.30                | 9,078.69                                | 299,483.99   |
| Unexpended balance June 30, 1918         |                           |                                         | 1,797.01     |
| Total appropriated, etc.                 |                           |                                         | 301,281.00   |

<sup>1</sup> The amount, \$272,312.08, reported in annual report for 1917 has been decreased \$5.72 by refund for overpayment by the secretary and to correct clerical error, as follows:

July, 1917, voucher 107, June, 1917

To correct clerical error

APPROPRIATION FOR FLOOD CONTROL, MISSISSIPPI RIVER, AND SACRAMENTO  
RIVER, CAL.

Allotment, June 20, 1917, from appropriation by sundry civil act  
of June 12, 1917----- \$5,660,000.00

## Miscellaneous receipts:

Amount received from sale of contact prints—

By fourth district officer—

From sale of contact prints in May, 1918, credited  
to allotments indicated—

“Surveys”----- \$10.25  
“Lower Tensas levee district”----- 2.00  
“Barataria levee district”----- 1.25  
“Pontchartrain levee district”----- 2.00  
“Plant”----- 1.25  
“Atchafalaya and Red River, La.”----- 2.00

Amount received in May, 1918, from rental of  
barges, credited to allotment for “Plant,” first  
and second districts----- 1,141.39

Amount received in June, 1918, from rental of  
plant, credited to allotment for “Plant,” first  
and second districts----- 1,485.00

Amount received in March, 1918, from New Or-  
leans, La., engineer district, for wear and tear  
of plant, constructing barges, credited to allot-  
ment for “Plant,” fourth district----- 883.83

Amount received in June, 1918, from first New  
Orleans, La., engineer district for wear and tear  
of plant, constructing barges (ED 99661-32-33-  
34), credited to allotment for “Plant,” fourth dis-  
trict----- 3,851.55

Amount received in June, 1918, from Panama  
Canal, for wear and tear of plant, constructing  
barges, (ED 91263-376), credited to allotment  
for “Plant,” fourth district----- 505.25

Total miscellaneous receipts----- 7,885.77

Total----- 5,667,885.77

*Expended.*

| Location and object.                                                                    | To June 30,<br>1917. | During year<br>ending<br>June 30, 1918. | Total.       |
|-----------------------------------------------------------------------------------------|----------------------|-----------------------------------------|--------------|
| Mississippi River Commission.....                                                       |                      | \$35,622.13                             | \$35,622.13  |
| Surveys, gauges, and observations.....                                                  |                      | 39,247.16                               | 39,247.16    |
| Levees, Head of Passes to Rock Island, Ill.....                                         |                      | 943,587.94                              | 943,587.94   |
| Revetment and contraction works, permanent channel im-<br>provement and protection..... |                      | 1,139,805.39                            | 1,139,805.39 |
| Dredges and dredging.....                                                               |                      | 152,481.92                              | 152,481.92   |
| Plant and miscellaneous.....                                                            |                      | 238,536.38                              | 238,536.38   |
| Improving harbors and tributaries, except Memphis Harbor.....                           |                      | 36,762.01                               | 36,762.01    |
| Memphis Harbor.....                                                                     |                      | 188,256.72                              | 188,256.72   |
| Total expended.....                                                                     |                      | 2,774,299.65                            | 2,774,299.65 |
| Balance unexpended June 30, 1918.....                                                   |                      |                                         | 2,893,586.12 |
| Total appropriated, etc.....                                                            |                      |                                         | 5,667,885.77 |

APPROPRIATION FOR REBUILDING LEVEES OF THE MISSISSIPPI RIVER AND TRIBUTARIES  
DAMAGED BY FLOODS.

Joint resolution of Apr. 30, 1912----- \$1,500,000.00

## Allotments—

Surveys, Ohio and Mississippi Rivers (allot-  
ment May 8, 1912)----- \$1,000.00

Cairo drainage district (allotment May 21,  
1912)----- 45,000.00

## Allotments—Continued.

|                                                                                                                                                                                                                |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Upper St. Francis levee district (allotments May 21, 1912, \$65,000, and June 18, 1912, \$15,000)-----                                                                                                         | \$80,000.00  |
| Reelfoot levee district (allotment May 21, 1912)-----                                                                                                                                                          | 60,000.00    |
| Lower St. Francis levee district (allotments May 21, 1912, \$200,000, June 18, 1912, \$60,000)-----                                                                                                            | 260,000.00   |
| White River levee district (allotment May 21, 1912)-----                                                                                                                                                       | 175,000.00   |
| Lower Yazoo levee district (allotment May 21, 1912)-----                                                                                                                                                       | 173,000.00   |
| Upper Tensas levee district (allotment May 21, 1912)-----                                                                                                                                                      | 269,000.00   |
| Red River levees (allotment May 21, 1912)---                                                                                                                                                                   | 10,000.00    |
| Atchafalaya levee district (allotment May 21, 1912)-----                                                                                                                                                       | 150,000.00   |
| Lafourche levee district (allotment May 21, 1912)-----                                                                                                                                                         | 100,000.00   |
| Lake Borgne levee district (allotment May 21, 1912)-----                                                                                                                                                       | 10,000.00    |
| East bank Mississippi River from Vicksburg to Bayou Sara, previously reported as allotments to Gum Ridge drainage district, Miss., Fort Adams to Tunica, La., and Bayou Sara, La. (approved May 21, 1912)----- | 50,000.00    |
| Lower Tensas levee district, Palmyra (allotment June 18, 1912)-----                                                                                                                                            | 11,000.00    |
| Lower Tensas levee district, Bougere (allotment June 18, 1912)-----                                                                                                                                            | 9,000.00     |
| Bayou des Glaisses, Atchafalaya, Red River, etc. (allotment June 18, 1912)-----                                                                                                                                | 30,000.00    |
| Lower Yazoo levee district (allotment July 22, 1912)-----                                                                                                                                                      | 37,000.00    |
| Upper Tensas levee district (allotment July 22, 1912)-----                                                                                                                                                     | 30,000.00    |
|                                                                                                                                                                                                                | 1,500,000.00 |

Miscellaneous receipts, previously reported----- \$1,169.66

1,501,169.66

*Expended.*

|                                                               | To June 30, 1917. | During year ending June 30, 1918. | Total.         |
|---------------------------------------------------------------|-------------------|-----------------------------------|----------------|
| Expenditures.....                                             | \$1,445,114.49    | .....                             | \$1,445,114.49 |
| Unexpended balance, carried to surplus fund June 30, 1914.... | .....             | .....                             | 56,055.17      |
| Total appropriated, etc.....                                  | .....             | .....                             | 1,501,169.66   |

APPROPRIATION FOR IMPROVING YAZOO RIVER AND TRIBUTARIES, MISS.<sup>1</sup>

|                                                    |              |
|----------------------------------------------------|--------------|
| Act of July 13, 1892-----                          | \$75,000.00  |
| Act of Aug. 18, 1894-----                          | 225,000.00   |
| Act of Aug. 18, 1894-----                          | 40,000.00    |
| Act of June 4, 1897-----                           | 350,000.00   |
| Act of Mar. 3, 1901-----                           | 510,000.00   |
| Act of Mar. 3, 1909 (allotment Mar. 29, 1909)----- | 44,000.00    |
| Act of June 25, 1910-----                          | 4,000.00     |
| Act of July 25, 1912-----                          | 5,000.00     |
| Act of Mar. 4, 1913-----                           | 10,000.00    |
|                                                    | 1,263,000.00 |
| Miscellaneous receipts, previously reported-----   | .30          |
| Total-----                                         | 1,263,000.30 |

<sup>1</sup> Funds under this appropriation were transferred to the control of the district engineer officer, Vicksburg, Miss., district, Oct. 9, 1916, under provision of river and harbor act July 27, 1916.

*Expended.*

|                              | To June 30,<br>1917. | During year<br>ending<br>June 30, 1918. | Total.         |
|------------------------------|----------------------|-----------------------------------------|----------------|
| Expenditures.....            | \$1,248,277.78       |                                         | \$1,248,277.78 |
| Unexpended balance.....      |                      |                                         | 14,722.52      |
| Total appropriated, etc..... |                      |                                         | 1,263,000.30   |

<sup>1</sup> Funds under this appropriation were transferred to the control of the district engineer officer, Vicksburg, Miss., district, Oct. 9, 1916, under provision of river and harbor act July 27, 1916.

APPROPRIATION FOR MAINTAINING AND PROTECTING LEVEES OF MISSISSIPPI RIVER  
AND TRIBUTARIES AGAINST FLOODS.

|                                                               |              |
|---------------------------------------------------------------|--------------|
| Act of Apr. 3, 1912.....                                      | \$350,000.00 |
| Act of Apr. 16, 1912.....                                     | 300,000.00   |
| Total specific appropriations.....                            | 650,000.00   |
| Miscellaneous receipts previously reported.....               | 490.80       |
| Total.....                                                    | 650,490.80   |
| Expended to June 30, 1914.....                                | 454,124.11   |
| Amount carried to surplus fund June 30, 1913.....             | 195,850.59   |
| Unexpended balance carried to surplus fund June 30, 1914..... | 516.10       |
| Total.....                                                    | 650,490.80   |

APPROPRIATION FOR EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND  
HARBORS.

|                                                                                              |          |
|----------------------------------------------------------------------------------------------|----------|
| Allotments from appropriation by river and harbor act of Mar. 3,<br>1905:                    |          |
| For Ashport, Tenn. (allotments Mar. 29, 1905, \$25, and May 8,<br>1905, \$460).....          | \$485.00 |
| Allotment from appropriation by river and harbor act of Mar. 4,<br>1913:                     |          |
| For canal leading from Centennial Lake at Vicksburg, Miss., to<br>the Mississippi River..... | 2,000.00 |
|                                                                                              | 2,485.00 |
| Expended during fiscal year 1906.....                                                        | \$485.00 |
| Expended during fiscal year 1914.....                                                        | 2,000.00 |
|                                                                                              | 2,485.00 |

APPROPRIATION FOR REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDAN-  
GERING NAVIGATION—INDEFINITE.

|                                                                      |            |
|----------------------------------------------------------------------|------------|
| Allotment for removing wreck of barkentine <i>Rachel Emery</i> ..... | \$1,500.00 |
| Expended in fiscal year 1913.....                                    | 1,500.00   |
| Allotment for removing wreck of bark <i>Santos Amaral</i> .....      | 8,000.00   |
| June 30, 1916, expended in fiscal year.....                          | \$6.11     |
| Expended during fiscal year 1917.....                                | 7,993.89   |
|                                                                      | 8,000.00   |

APPROPRIATION FOR REPAIRING GOVERNMENT LEVEE AT WALNUT BEND, ARK.<sup>1</sup>

|                                              |             |
|----------------------------------------------|-------------|
| Act of June 13, 1902 (river and harbor)..... | \$90,000.00 |
| Expended to June 30, 1906.....               | 90,000.00   |

APPROPRIATION FOR WATERWAY FROM LOCKPORT, ILL., TO ST. LOUIS, MO.

|                                                                                                                                                |             |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Act of June 13, 1902 (river and harbor).....                                                                                                   | \$25,000.00 |
| Amount transferred from allotment for "Survey of Illinois and<br>Des Plaines Rivers, Ill.," as reimbursement.....                              | 1,093.40    |
| Total.....                                                                                                                                     | 26,093.40   |
| Expended to June 30, 1906.....                                                                                                                 | \$22,291.23 |
| Unexpended balance carried to surplus fund on June 30,<br>1909, under the provisions of section 10 of sundry<br>civil act of Mar. 4, 1909..... | 3,802.17    |
|                                                                                                                                                | 26,093.40   |

<sup>1</sup> Prior to June 30, 1906, was reported under appropriation for "Mississippi River."

## 3486 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

## APPROPRIATION FOR EMERGENCIES IN RIVER AND HARBOR WORKS.

Allotments from appropriation by act of Apr. 28, 1904:

|                                                |            |
|------------------------------------------------|------------|
| For Wolf River (allotment July 6, 1904)        | \$8,000.00 |
| For Giles Bend, Miss. (allotment July 6, 1904) | 40,000.00  |

|                            |           |
|----------------------------|-----------|
| Expend in fiscal year 1905 | 48,000.00 |
|----------------------------|-----------|

Allotments from appropriation by act of Mar. 3, 1905:

|                                                                             |           |
|-----------------------------------------------------------------------------|-----------|
| For Old River (allotments Oct. 5, 1908, \$6,000 and Nov. 12, 1908, \$4,000) | 10,000.00 |
|-----------------------------------------------------------------------------|-----------|

|                            |           |
|----------------------------|-----------|
| Expend in fiscal year 1909 | 10,000.00 |
|----------------------------|-----------|

## APPROPRIATION FOR CLAIMS FOR DAMAGES BY COLLISION, RIVER AND HARBOR WORKS.

|                                         |       |
|-----------------------------------------|-------|
| Act of Apr. 6, 1914 (urgent deficiency) | 73.84 |
| Expend in fiscal year 1914              | 73.84 |

|                                           |        |
|-------------------------------------------|--------|
| Act of Sept. 8, 1916 (general deficiency) | 475.28 |
| Expend in fiscal year 1917                | 475.28 |

## CONTRIBUTED FUNDS.

|                                                              |              |
|--------------------------------------------------------------|--------------|
| For improvement of Mississippi River at Trotters Point, Miss | \$100,000.00 |
| June 30, 1914, expended in fiscal year                       | 100,000.00   |

|                                                         |            |
|---------------------------------------------------------|------------|
| For improvement of Mississippi River near Memphis, Tenn | 1,800.00   |
| June 30, 1914, expended in fiscal year                  | \$1,066.61 |
| Unexpended balance refunded to contributor              | 733.39     |
|                                                         | 1,800.00   |

|                                                                 |             |
|-----------------------------------------------------------------|-------------|
| For improvement of Mississippi River at Star Landing Bend, Miss | 210,000.00  |
| June 30, 1914, expended in fiscal year                          | \$35,009.30 |
| June 30, 1915, expended in fiscal year                          | 174,990.70  |
|                                                                 | 210,000.00  |

|                                                               |          |
|---------------------------------------------------------------|----------|
| For improvement of Mississippi River near Laconia Circle, Ark | 8,000.00 |
| June 30, 1915, expended in fiscal year                        | 8,000.00 |

|                                                     |             |
|-----------------------------------------------------|-------------|
| For improvement of Mississippi River at Delta, Miss | 160,000.00  |
| June 30, 1915, expended in fiscal year              | \$24,871.79 |
| June 30, 1916, expended in fiscal year              | 135,128.21  |
|                                                     | 160,000.00  |

|                                                                          |             |
|--------------------------------------------------------------------------|-------------|
| For improvement of Mississippi River in Upper St. Francis levee district | 234,000.00  |
| June 30, 1917, expended in fiscal year                                   | \$26,734.69 |
| June 30, 1918, expended in fiscal year                                   | 78,919.31   |
| July 1, 1918, amount covered by existing contracts                       | 128,346.00  |
|                                                                          | 234,000.00  |

|                                                         |            |
|---------------------------------------------------------|------------|
| For improvement of Mississippi River at Gayoso Bend, Mo | 150,000.00 |
| June 30, 1917, expended in fiscal year                  | 150,000.00 |

|                                                                                |           |
|--------------------------------------------------------------------------------|-----------|
| For improvement of Mississippi River in the Reelfoot levee district (Kentucky) | 25,000.00 |
| June 30, 1917, expended in fiscal year                                         | 25,000.00 |

|                                                       |           |
|-------------------------------------------------------|-----------|
| For improvement of Mississippi River at Norfolk, Miss | 50,000.00 |
| June 30, 1918, expended in fiscal year                | 50,000.00 |

|                                                      |             |
|------------------------------------------------------|-------------|
| For improvement of Mississippi River at Avondale, La | 45,000.00   |
| June 30, 1914, expended in fiscal year               | \$32,467.28 |
| Unexpended balance refunded to contributor           | 12,532.72   |
|                                                      | 45,000.00   |

|                                                    |            |
|----------------------------------------------------|------------|
| For improvement of Mississippi River at Torras, La | 3,000.00   |
| June 30, 1914, expended in fiscal year             | \$2,453.74 |
| Unexpended balance refunded to contributor         | 546.26     |
|                                                    | 3,000.00   |

DS CONTRIBUTED BY LOCAL LEVEE DISTRICTS FOR FLOOD CONTROL, MISSISSIPPI RIVER, IN ACCORDANCE WITH SUNDRY CIVIL ACT, JUNE 12, 1917.

tributed for flood control, Mississippi River, in fiscal year ending June 30, 1918..... \$1, 373, 201. 67

titulation of appropriations, expenditures, etc., under direction of the Mississippi River Commission to June 30, 1918.

| Appropriation for—                                                                  | Expended during fiscal year ending June 30, 1918. | Expended to June 30, 1918. | Deductions.                      | Balance unexpended June 30, 1918. | Total appropriated, etc.             |
|-------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------|----------------------------------|-----------------------------------|--------------------------------------|
| <b>ECIFIC APPROPRIATIONS.</b>                                                       |                                                   |                            |                                  |                                   |                                      |
| Mississippi River.....                                                              | \$2, 636, 514. 44                                 | \$82, 520, 519. 71         | <sup>1</sup> \$7, 598. 06        | \$920, 280. 04                    | \$83, 448, 397. 81                   |
| Maintenance and improvement of existing river and harbor works.....                 | 292, 647. 84                                      | 7, 263, 596. 30            | .....                            | 497, 909. 43                      | 7, 761, 505. 73                      |
| Flood Control, Mississippi River, and Sacramento River, Cal.....                    | 2, 774, 299. 65                                   | 2, 774, 299. 65            | .....                            | 2, 893, 586. 12                   | 5, 667, 885. 77                      |
| Building levees of the Mississippi River and its tributaries damaged by floods..... | .....                                             | 1, 445, 114. 49            | <sup>1</sup> 56, 055. 17         | .....                             | 1, 501, 169. 66                      |
| Maintaining and protecting Mississippi River and tributaries against floods.....    | .....                                             | 454, 124. 11               | <sup>1</sup> 196, 366. 69        | .....                             | 650, 490. 80                         |
| Investigations, surveys, and contingencies of rivers and harbors.....               | .....                                             | 2, 485. 00                 | .....                            | .....                             | 2, 485. 00                           |
| Repairing Government levee, Walnut Bend, Ark.....                                   | .....                                             | 90, 000. 00                | .....                            | .....                             | 90, 000. 00                          |
| Levee from Lockport, Ill., to St. Louis, Mo.....                                    | .....                                             | 22, 291. 23                | <sup>1</sup> 3, 802. 17          | .....                             | 26, 093. 40                          |
| Emergency repairs in river and harbor works.....                                    | .....                                             | 58, 000. 00                | .....                            | .....                             | 58, 000. 00                          |
| <b>Total.....</b>                                                                   | <b>5, 703, 461. 93</b>                            | <b>94, 630, 430. 49</b>    | <b><sup>1</sup> 263, 822. 09</b> | <b>4, 311, 775. 59</b>            | <b><sup>2</sup> 99, 206, 028. 17</b> |
| <b>CONTRIBUTED FUNDS.</b>                                                           |                                                   |                            |                                  |                                   |                                      |
| Contributed funds, improvement Mississippi River.....                               | 128, 919. 31                                      | 844, 641. 63               | <sup>3</sup> 13, 812. 37         | 128, 346. 00                      | 986, 800. 00                         |
| Contributed funds, flood-control act.....                                           | 278, 264. 67                                      | 278, 264. 67               | .....                            | 1, 094, 937. 00                   | 1, 373, 201. 67                      |
| .....                                                                               | 407, 183. 98                                      | 1, 122, 906. 30            | <sup>3</sup> 13, 812. 37         | 1, 223, 283. 00                   | <sup>4</sup> 2, 360, 001. 67         |
| .....                                                                               | .....                                             | .....                      | .....                            | .....                             | .....                                |
| .....                                                                               | 6, 110, 645. 91                                   | 95, 753, 336. 76           | 277, 634. 46                     | 5, 535, 058. 59                   | <sup>5</sup> 101, 566, 029. 84       |
| <b>PERMANENT APPROPRIATIONS, ETC.</b>                                               |                                                   |                            |                                  |                                   |                                      |
| .....                                                                               | .....                                             | .....                      | .....                            | .....                             | .....                                |
| .....                                                                               | 8, 217. 85                                        | 140, 716. 44               | <sup>7</sup> 12, 018. 93         | 1, 797. 67                        | 154, 533. 04                         |
| .....                                                                               | .....                                             | <sup>8</sup> 4, 442. 29    | <sup>9</sup> 14, 722. 52         | .....                             | 19, 164. 81                          |
| .....                                                                               | .....                                             | 9, 500. 00                 | .....                            | .....                             | 9, 500. 00                           |
| .....                                                                               | .....                                             | 549. 12                    | .....                            | .....                             | 549. 12                              |
| <b>Total.....</b>                                                                   | <b>8, 217. 85</b>                                 | <b>155, 207. 85</b>        | <b>26, 741. 45</b>               | <b>1, 797. 67</b>                 | <b>183, 746. 97</b>                  |

Carried to surplus fund.

To reduce to net appropriations as shown on line 6 of the financial summary, deduct \$470,849.21 account receipts from sales and amounts carried to surplus fund.

Returned to contributors.

To reduce to net contribution as shown on line 6 of the financial summary, deduct \$13,812.37 account amount returned to contributors.

See notes <sup>2</sup> and <sup>4</sup>.

Since February 11, 1901.

Unexpended balance reverted to Treasury.

Since Mar. 4, 1913.

Transferred to control of District Engineer Officer, Vicksburg (Miss.) District, Oct. 9, 1916, under provisions of river and harbor act July 27, 1916. (E D 7715-38.)

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918.*

SECRETARY, MISSISSIPPI RIVER COMMISSION.

[Appropriations: Mississippi River; flood control, Mississippi River and Sacramento River, Cal.; contributed for flood control, Mississippi River; maintenance and improvement of existing river harbor works; gauging waters of the Mississippi River and its tributaries; increase of compensation for river and harbor pilots, 1918; waterway from Lockport, Ill., to St. Louis, Mo.; for claims for damage collision, river and harbor works.]

|                                                                                                                                        | Appropriation for Mississippi River, allotment for |                                               |                             |                                                       |                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------|-----------------------------|-------------------------------------------------------|--------------------------------------------------------------------|
|                                                                                                                                        | Mississippi<br>River Com-<br>mission.              | Surveys,<br>gauges, and<br>observa-<br>tions. | Dredges<br>and<br>dredging. | Levees,<br>Rock<br>Island to<br>New Bos-<br>ton, Ill. | Levee<br>Mus-<br>catine<br>mouth<br>of Lo-<br>uisa<br>River<br>Low |
| Amount expended on previous projects.....                                                                                              | \$238, 110.74                                      | \$855, 247.37                                 | -----                       | -----                                                 | -----                                                              |
| Amount expended on present project to end<br>of last fiscal year.....                                                                  | 843, 640.73                                        | 1, 746, 323.95                                | \$6, 497, 621.53            | \$275.12                                              | \$37                                                               |
| Balance unexpended at end of last fiscal year.                                                                                         | 16, 657.59                                         | 15, 265.59                                    | 184, 937.38                 | 14, 724.88                                            | 29, 62                                                             |
| Receipts from sales, etc., this fiscal year:                                                                                           |                                                    |                                               |                             |                                                       |                                                                    |
| By transfer from allotment for levees, La<br>Grange to mouth of Missouri River,<br>Mo., act of Mar. 4, 1913 <sup>2</sup> .....         |                                                    |                                               |                             | 2, 146.28                                             |                                                                    |
| By transfer from allotment for levees,<br>head of Chouteau Island to Prairie du<br>Pont, Ill., act of July 27, 1916 <sup>3</sup> ..... |                                                    |                                               |                             |                                                       | 5, 50                                                              |
| Proceeds from rental of steamboats Noko-<br>mis and Sachem <sup>4</sup> .....                                                          |                                                    |                                               | 3, 480.00                   |                                                       |                                                                    |
| Proceeds from rental of steamboat Leota <sup>5</sup> .....                                                                             |                                                    |                                               | 1, 715.00                   |                                                       |                                                                    |
| Proceeds from docking Lee Line steamer<br>Eclipse <sup>6</sup> .....                                                                   |                                                    |                                               | 842.90                      |                                                       |                                                                    |
| Collection of stoppage against pay of a<br>United States employee <sup>7</sup> .....                                                   |                                                    |                                               | 19.33                       |                                                       |                                                                    |
| Reimbursement for coal furnished United<br>States snagboat John N. Macomb <sup>8</sup> .....                                           |                                                    |                                               | 619.19                      |                                                       |                                                                    |
| Reimbursement for coal furnished first<br>and second Mississippi River Commis-<br>sion districts <sup>9</sup> .....                    |                                                    |                                               | 26, 798.04                  |                                                       |                                                                    |
| Received for rental, etc., of boats <sup>10</sup> .....                                                                                |                                                    |                                               | 3, 753.81                   |                                                       |                                                                    |
| Received from sale of coal to Chicago &<br>Eastern Illinois R.R. for steamer Leota <sup>11</sup> .....                                 |                                                    |                                               | 271.19                      |                                                       |                                                                    |
|                                                                                                                                        | 16, 657.59                                         | 15, 265.59                                    | 222, 436.84                 | 16, 871.16                                            | 35, 12                                                             |
| Amount expended from beginning of present<br>fiscal year to end of previous month.....                                                 | 15, 864.41                                         | 7, 080.71                                     | <sup>12</sup> 183, 111.95   | 140.14                                                | 4, 96                                                              |
| Amount expended during the month.....                                                                                                  | 15, 864.41                                         | 7, 098.21                                     | <sup>13</sup> 186, 146.14   | 140.14                                                | 6, 89                                                              |
| Balance unexpended at end of month.....                                                                                                | 793.18                                             | 8, 167.38                                     | 36, 290.70                  | 16, 731.02                                            | 28, 22                                                             |
| In Treasury United States.....                                                                                                         | 48.99                                              | 263.24                                        | 36, 290.70                  | 10, 724.88                                            | 22, 94                                                             |
| In hand.....                                                                                                                           | 744.19                                             | 7, 904.14                                     |                             | 6, 006.14                                             | 5, 27                                                              |
|                                                                                                                                        | 793.18                                             | 8, 167.38                                     | 36, 290.70                  | 16, 731.02                                            | 28, 22                                                             |
| Outstanding liabilities at end of month.....                                                                                           | 283.73                                             | 102.59                                        | 2, 467.27                   | 79.50                                                 | 71                                                                 |
| Amount covered by existing contracts at end<br>of month.....                                                                           |                                                    | 7, 942.00                                     |                             | 15, 425.00                                            | 25, 35                                                             |
|                                                                                                                                        | 283.73                                             | 8, 044.59                                     | 2, 467.27                   | 15, 504.50                                            | 26, 07                                                             |
| Balance available at end of month.....                                                                                                 | 509.35                                             | 122.79                                        | <sup>14</sup> 33, 823.43    | 1, 226.52                                             | 2, 15                                                              |

<sup>1</sup> Experimental dikes, \$45,075.58; patrol of the Mississippi River, \$1,055.56; spillway surveys, \$15, levees, Muscatine to Port Louisa, Iowa, \$99.91; levees, Grand Tower to near Thebes, Ill., \$10, examination from Cape Girardeau, Mo., to Rock Island, Ill., \$10,000.

<sup>2</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief Engineers, Nov. 6, 1917. (ED 89361-69, Sec. MRC 1936-2190.)

<sup>3</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief Engineers, Nov. 6, 1917. (ED 89361-72, Sec. MRC 1936-2189.)

<sup>4</sup> Under lease between Lieut. Col. Clarke S. Smith, Corps of Engineers, U. S. Army, and Edward F. C. tra, dated July 30, 1917, approved by Chief of Engineers, Aug. 28, 1917. (ED 114290-3, Sec. MRC 2438-)

<sup>5</sup> Under lease between Edward J. Thomas, assistant engineer, special disbursing agent, U. S. Army, William J. Jackson, receiver, Chicago & Eastern Illinois R. R. Co., dated Mar. 6, 1918. (Sec. MRC 2557-)

<sup>6</sup> Docked at West Memphis, Ark. (ED 78130-29, Sec. MRC 2045-29.)

<sup>7</sup> For destruction of public property, deposited to credit of Treasurer of United States, May 31, 1918, certificate of deposit No. 638.

<sup>8</sup> From St. Louis district engineer on lease. (ED 104197-2151, Sec. MRC 1256-84.)

<sup>9</sup> From first and second Mississippi River Commission district. (ED 104197-2197, Sec. MRC 369-34)

<sup>10</sup> From first and second Mississippi River Commission district for use of dredge Delta, steamers Le and Saturn, and pile sinker No. 933. (ED 104197-2251, Sec. MRC 1615-70.)

<sup>11</sup> Deposited to credit of Treasurer of United States, June 29, 1918, certificate of deposit No. 744.

<sup>12</sup> Amount, \$183,090.03, previously reported increased \$21.92; formerly reported on voucher 149, M 1918, as expended under allotment for dredges and dredging, appropriation for flood control, Mississippi River and Sacramento River, Cal.

<sup>13</sup> Includes \$153.85 reimbursable for coal furnished the first and second Mississippi River Commission districts.

<sup>14</sup> Does not include \$153.85, reimbursable for coal furnished the first and second Mississippi River Commission districts.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                                  | Appropriation for Mississippi River, allotment for— |                                |                                                   |                                     |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------|---------------------------------------------------|-------------------------------------|
|                                                                                                                                  | Levees, Oquawka to Dallas, Ill.                     | Levees, Warsaw to Quincy, Ill. | Levees, La Grange to mouth of Missouri River, Mo. | Levees, Quincy to Hamburg Bay, Ill. |
| Amount expended on present project to end of last fiscal year.....                                                               | \$691.89                                            | \$18,150.78                    | \$39,481.78                                       | \$24,776.59                         |
| Balance unexpended at end of last fiscal year.....                                                                               | 19,308.11                                           | 31,849.22                      | 20,418.31                                         | 105,223.41                          |
| Receipts from sales, etc., this fiscal year:                                                                                     |                                                     |                                |                                                   |                                     |
| By transfer from allotment for levees, head of Chouteau Island to Prairie du Pont, Ill., act of July 27, 1916 <sup>1</sup> ..... |                                                     | 5,600.00                       |                                                   |                                     |
|                                                                                                                                  | 19,308.11                                           | 37,449.22                      | 20,418.31                                         | 105,223.41                          |
| By transfer to allotment for levees, Rock Island to New Boston, Ill., act of Mar. 4, 1913 <sup>2</sup> .....                     |                                                     |                                | 2,146.28                                          |                                     |
| Amount expended from beginning of present fiscal year to end of previous month.....                                              | 215.51                                              | 34,146.25                      | 18,257.76                                         | 25,290.23                           |
| Amount expended during the month.....                                                                                            |                                                     | 61.35                          |                                                   | 124.19                              |
|                                                                                                                                  | 215.51                                              | 34,207.60                      | 20,404.04                                         | 25,414.42                           |
| Balance unexpended at end of month.....                                                                                          | 19,092.60                                           | 3,241.62                       | 14.27                                             | 79,808.99                           |
| In Treasury United States.....                                                                                                   | 18,308.11                                           | 200.00                         |                                                   | 79,223.41                           |
| In hand.....                                                                                                                     | 784.49                                              | 3,041.62                       | 14.27                                             | 585.58                              |
|                                                                                                                                  | 19,092.60                                           | 3,241.62                       | 14.27                                             | 79,808.99                           |
| Outstanding liabilities at end of month.....                                                                                     |                                                     | 118.25                         |                                                   |                                     |
| Amount covered by existing contracts at end of month.....                                                                        |                                                     |                                |                                                   | 4,422.03                            |
|                                                                                                                                  |                                                     | 118.25                         |                                                   | 4,422.03                            |
| Balance available at end of month.....                                                                                           | 19,092.60                                           | 3,123.37                       | 14.27                                             | 75,386.96                           |

<sup>1</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief of Engineers, Nov. 6, 1917. (ED 89361-72, Sec. MRC 1936-2190.)

<sup>2</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief of Engineers, Nov. 6, 1917. (ED 89361-69, Sec. MRC 1936-2190.)

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                                               | Appropriation for Mississippi River, allotment for—      |                                                |                      |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------|----------------------|----------------|
|                                                                                                                                               | Levees, head of Chouteau Island to Prairie du Pont, Ill. | Levees, Grand Tower to Gale, near Thebes, Ill. | Expended allotments. | Total.         |
| Amount expended on previous projects.....                                                                                                     |                                                          |                                                |                      | \$1,093,358.11 |
| Amount expended on present project to end of last fiscal year.....                                                                            | \$60,678.12                                              | \$4,163.30                                     | \$91,231.05          | 9,317,408.02   |
| Balance unexpended at end of last fiscal year.....                                                                                            | 24,321.88                                                | 15,836.70                                      |                      | 478,169.86     |
| Receipts from sales, etc., this fiscal year:                                                                                                  |                                                          |                                                |                      |                |
| By transfer from allotment for levees, La Grange to mouth of Missouri River, Mo., act of Mar. 4, 1913 <sup>1</sup> .                          |                                                          |                                                |                      | 2,146.28       |
| By transfer from allotment for levees, head of Chouteau Island to Prairie du Pont, Ill., act of July 27, 1916 <sup>2</sup> .                  |                                                          |                                                |                      | 11,100.00      |
| Proceeds from rental of steamboats Nokomis and Sachem <sup>3</sup> .                                                                          |                                                          |                                                |                      | 3,480.00       |
| Proceeds from rental of steamboat Leota <sup>4</sup> .                                                                                        |                                                          |                                                |                      | 1,715.00       |
| Proceeds from docking Lee Line steamer Eclipse <sup>5</sup> .                                                                                 |                                                          |                                                |                      | 842.90         |
| Collection of stoppage against pay of a United States employee <sup>6</sup> .                                                                 |                                                          |                                                |                      | 19.33          |
| Reimbursement for coal furnished United States snagboat John N. Macomb <sup>7</sup> .                                                         |                                                          |                                                |                      | 619.10         |
| Reimbursement for coal furnished first and second Mississippi River Commission districts <sup>8</sup> .                                       |                                                          |                                                |                      | 26,798.04      |
| Received for rental, etc., of boats <sup>9</sup> .                                                                                            |                                                          |                                                |                      | 3,753.81       |
| Received from sale of coal to Chicago & Eastern Illinois R. R. for steamer Leota <sup>10</sup> .                                              |                                                          |                                                |                      | 271.10         |
|                                                                                                                                               | 24,321.88                                                | 15,836.70                                      |                      | 528,915.63     |
| By transfer to allotment for levees, Rock Island to New Boston, Ill., act of Mar. 4, 1913 <sup>1</sup> .                                      |                                                          |                                                |                      | 2,146.28       |
| By transfer to allotments for levees, Muscatine to mouth of Iowa River, Iowa, and Warsaw to Quincy, Ill., act of July 27, 1916 <sup>2</sup> . | 11,100.00                                                |                                                |                      | 11,100.00      |
| Amount expended from beginning of present fiscal year to end of previous month.....                                                           | 13,221.88                                                | 10,318.29                                      |                      | 312,614.63     |
| Amount expended during the month.....                                                                                                         |                                                          | 421.60                                         |                      | 5,589.80       |
|                                                                                                                                               | 24,321.88                                                | 10,739.89                                      |                      | 331,450.70     |
| Balance unexpended at end of month.....                                                                                                       |                                                          | 5,096.81                                       |                      | 197,464.87     |
| In Treasury United States.....                                                                                                                |                                                          | 36.70                                          |                      | 168,044.77     |
| In hand.....                                                                                                                                  |                                                          | 5,060.11                                       |                      | 29,420.10      |
|                                                                                                                                               |                                                          | 5,096.81                                       |                      | 197,464.87     |
| Outstanding liabilities at end of month.....                                                                                                  |                                                          | 287.10                                         |                      | 4,056.99       |
| Amount covered by existing contracts at end of month.....                                                                                     |                                                          | 4,179.75                                       |                      | 57,325.44      |
|                                                                                                                                               |                                                          | 4,466.85                                       |                      | 61,382.44      |
| Balance available at end of month.....                                                                                                        |                                                          | 629.96                                         |                      | 136,082.44     |

<sup>1</sup> Experimental dikes, \$45,075.58; patrol of the Mississippi River, \$1,055.56; spillway surveys, \$15,000 levees, Muscatine to Port Louisa, Iowa, \$99.91; levees, Grand Tower to near Thebes, Ill., \$10,000 examination from Cape Girardeau, Mo., to Rock Island, Ill., \$10,000.

<sup>2</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief of Engineers Nov. 6, 1917. (ED 89361-69, Sec. MRC 1936-2190.)

<sup>3</sup> By resolution of the Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief of Engineers Nov. 6, 1917. (ED 89361-72, Sec. MRC 1936-2189.)

<sup>4</sup> Under lease between Lieut. Col. Clarke S. Smith, Corps of Engineers, U. S. Army, and Edward F. Goltr dated July 30, 1917, approved by Chief of Engineers, Aug. 28, 1917. (ED 114290-3, Sec. MRC 2438-11.)

<sup>5</sup> Under lease between Edward J. Thomas, assistant engineer, special disbursing agent, U. S. Army, and William J. Jackson, receiver, Chicago & Eastern Illinois R. R. Co., dated Mar. 6, 1918. (Sec. MRC 2557-12.)

<sup>6</sup> Docked at West Memphis, Ark. (ED 78130-29, Sec. MRC 2045-29.)

<sup>7</sup> For destruction of public property, deposited to credit of Treasurer of United States, May 31, 1918; certificate of deposit No. 638.

<sup>8</sup> From St. Louis district engineer office. (ED 104197-2151, Sec. MRC 1256-84.)

<sup>9</sup> From first and second Mississippi River Commission district. (ED 104197-2197, Sec. MRC 369-344.)

<sup>10</sup> From first and second Mississippi River Commission district for use of dredge Delta, steamers Leota and Saturn, and pile sinker No. 933. (ED 104197-2251, Sec. MRC 1615-70.)

<sup>11</sup> Deposited to credit of Treasurer of United States, June 29, 1918, certificate of deposit No. 744.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                     | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                                    |                         |              |                                         |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------|-------------------------|--------------|-----------------------------------------|
|                                                                                     | Mississippi River Commission.                                                                  | Surveys, gauges, and observations. | Dredges and dredging.   | New steamer. | Levees, Rock Island to New Boston, Ill. |
| Amount appropriated or allotted this fiscal year; act of June 12, 1917.....         | \$50,000.00                                                                                    | \$40,000.00                        | \$350,000.00            | \$196,000.00 | .....                                   |
| Receipts from sales, etc., this fiscal year:                                        |                                                                                                |                                    |                         |              |                                         |
| By transfer from allotment for levees                                               |                                                                                                |                                    |                         |              |                                         |
| Prairie du Pont to Grand Tower, Ill.,                                               |                                                                                                |                                    |                         |              |                                         |
| act of June 12, 1917 <sup>1</sup> .....                                             |                                                                                                |                                    |                         |              | \$55,000.00                             |
| Reimbursement for preparation of boats and use of marine ways <sup>2</sup> .....    |                                                                                                |                                    | 382.99                  |              |                                         |
|                                                                                     | 50,000.00                                                                                      | 40,000.00                          | 350,382.99              | 196,000.00   | 55,000.00                               |
| Amount expended from beginning of present fiscal year to end of previous month..... | 29,274.19                                                                                      | 27,346.92                          | <sup>3</sup> 136,847.31 |              | 63.33                                   |
| Amount expended during the month.....                                               | 6,347.94                                                                                       | 2,562.52                           | 16,017.60               |              | 26.85                                   |
|                                                                                     | 35,622.13                                                                                      | 29,909.44                          | 152,864.91              |              | 90.18                                   |
| Balance unexpended at end of month.....                                             | 14,377.87                                                                                      | 10,090.56                          | 197,518.08              | 196,000.00   | 54,909.82                               |
| Treasury United States.....                                                         | 16,735.72                                                                                      | —238.58                            | 160,382.99              | 196,000.00   | 49,000.00                               |
| hand.....                                                                           | —2,357.85                                                                                      | 10,329.14                          | 37,135.09               |              | 5,909.82                                |
|                                                                                     | 14,377.87                                                                                      | 10,090.56                          | 197,518.08              | 196,000.00   | 54,909.82                               |
| Outstanding liabilities at end of month.....                                        | 2,641.92                                                                                       | 2,422.38                           | 96,706.95               |              |                                         |
| Amount covered by existing contracts at end of month.....                           | 7.93                                                                                           | 3.88                               | 57.52                   |              | 50,766.67                               |
|                                                                                     | 2,649.85                                                                                       | 2,426.26                           | 96,764.47               |              | 50,766.67                               |
| Balance available at end of month.....                                              | 11,728.02                                                                                      | 7,664.30                           | 100,753.61              | 196,000.00   | 4,143.15                                |

<sup>1</sup> Approved by Acting Chief of Engineers, Feb. 9, 1918. (ED 15927-572, Sec. MRC 1936-2401.)

<sup>2</sup> From first and second Mississippi River Commission district for use of marine ways and preparation for rental of dredge Delta and steamer Leota. (ED 104197-2251, Sec. MRC 1615-70.)

<sup>3</sup> Amount, \$136,849.23, previously reported decreased \$21.92; transferred June, 1918, to expenditure under allotment for dredges and dredging, appropriation for Mississippi River.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                  | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotted for— |                                |                                                    |                                                      |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------|------------------------------------------------------|
|                                                                                                                  | Levees, Muscatine to mouth of Iowa River, Iowa.                                               | Levees, Warsaw to Quincy, Ill. | Levees, mouth of Des Moines River to La Grange Mo. | Levees, La Grange to mouth of Mississippi River, Mo. |
| Amount appropriated or allotted this fiscal year, act of June 12, 1917.....                                      | \$30,000.00                                                                                   | \$30,000.00                    | \$20,000.00                                        | \$70,000.00                                          |
| Receipts from sales, etc., this fiscal year:                                                                     |                                                                                               |                                |                                                    |                                                      |
| By transfer from allotment for levees, St. Louis to Cape Girardeau, Mo., act of June 12, 1917 <sup>1</sup> ..... |                                                                                               | 25,000.00                      |                                                    |                                                      |
|                                                                                                                  | 30,000.00                                                                                     | 55,000.00                      | 20,000.00                                          | 70,000.00                                            |
| Amount expended from beginning of present fiscal year to end of previous month.....                              | 76.71                                                                                         | 28.38                          | 8,365.60                                           | 1,100.00                                             |
| Amount expended during the month.....                                                                            | 16.91                                                                                         |                                | 2,510.90                                           | 3,700.00                                             |
|                                                                                                                  | 93.62                                                                                         | 28.38                          | 10,876.50                                          | 4,800.00                                             |
| Balance unexpended at end of month.....                                                                          | 29,906.38                                                                                     | 54,971.62                      | 9,123.50                                           | 65,200.00                                            |
| In Treasury United States.....                                                                                   | 28,992.33                                                                                     | 51,000.00                      | 5,608.19                                           | 59,800.52                                            |
| In hand.....                                                                                                     | 914.05                                                                                        | 971.62                         | 3,515.31                                           | 5,399.48                                             |
|                                                                                                                  | 29,906.38                                                                                     | 54,971.62                      | 9,123.50                                           | 65,200.00                                            |
| Outstanding liabilities at end of month.....                                                                     | 125.65                                                                                        | 14.81                          | 10.39                                              | 150.95                                               |
| Amount covered by existing contracts at end of month..                                                           | 26,250.00                                                                                     |                                | 3,165.80                                           | 49,800.00                                            |
|                                                                                                                  | 26,375.65                                                                                     | 14.81                          | 3,176.19                                           | 51,600.00                                            |
| Balance available at end of month.....                                                                           | 3,530.73                                                                                      | 54,956.81                      | 5,947.31                                           | 13,400.00                                            |

<sup>1</sup>Approved by Chief of Engineers, Feb. 9, 1918. (ED 15927-564, Sec. MRC 1936-2316.)

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                      | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                                              |                                               |              |
|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------|--------------|
|                                                                                                                      | Levees, St. Louis to Cape Girardeau, Mo.                                                       | Levees, Prairie du Pont to Grand Tower, Ill. | Levees, Grand Tower to Gale near Thebes, Ill. | Total.       |
| Amount appropriated or allotted this fiscal year, act of June 12, 1917.....                                          | \$50,000.00                                                                                    | \$55,000.00                                  | \$25,000.00                                   | \$916,000.00 |
| Receipts from sales, etc., this fiscal year:                                                                         |                                                                                                |                                              |                                               |              |
| By transfer from allotment for levees, St. Louis to Cape Girardeau, Mo., act of June 12, 1917 <sup>1</sup> .....     |                                                                                                |                                              | 25,600.00                                     | 25,000.00    |
| By transfer from allotment for levees, St. Louis to Cape Girardeau, Mo., act of June 12, 1917 <sup>2</sup> .....     |                                                                                                |                                              |                                               | 25,000.00    |
| By transfer from allotment for levees, Prairie du Pont to Grand Tower, Ill., act of June 12, 1917 <sup>3</sup> ..... |                                                                                                |                                              |                                               | 55,000.00    |
| Reimbursement for preparation of boats and use of marine ways <sup>4</sup> .....                                     |                                                                                                |                                              |                                               | 382.99       |
|                                                                                                                      | 50,000.00                                                                                      | 55,000.00                                    | 50,000.00                                     | 1,021,382.99 |
| By transfer to allotment for levees, Grand Tower to Gale, near Thebes, Ill., act of June 12, 1917 <sup>1</sup> ..... | 25,000.00                                                                                      |                                              |                                               | 25,000.00    |
| By transfer to allotment for levees, Warsaw to Quincy, Ill., act of June 12, 1917 <sup>2</sup> .....                 | 25,000.00                                                                                      |                                              |                                               | 25,000.00    |
| By transfer to allotment for levees, Rock Island to New Boston, Ill., act of June 12, 1917 <sup>3</sup> .....        |                                                                                                | 55,000.00                                    |                                               | 55,000.00    |
| Amount expended from beginning of present fiscal year                                                                |                                                                                                |                                              | 27.27                                         | 203,206.73   |
| Amount expended during the month.....                                                                                |                                                                                                |                                              | 1,454.73                                      | 32,663.18    |
|                                                                                                                      | 50,000.00                                                                                      | 55,000.00                                    | 1,482.00                                      | 340,869.91   |
| Balance unexpended at end of month.....                                                                              |                                                                                                |                                              | 48,518.00                                     | 680,513.08   |
| Treasury United States.....                                                                                          |                                                                                                |                                              | 43,992.33                                     | 614,359.76   |
| Hand.....                                                                                                            |                                                                                                |                                              | 4,525.67                                      | 66,153.32    |
|                                                                                                                      |                                                                                                |                                              | 48,518.00                                     | 680,513.08   |
| Outstanding liabilities at end of month.....                                                                         |                                                                                                |                                              | 3,931.16                                      | 107,604.39   |
| Amount covered by existing contracts at end of month.....                                                            |                                                                                                |                                              | 14,478.93                                     | 144,617.84   |
|                                                                                                                      |                                                                                                |                                              | 18,410.09                                     | 252,222.23   |
| Balance available at end of month.....                                                                               |                                                                                                |                                              | 30,107.91                                     | 428,290.85   |

By resolution of Mississippi River Commission, Oct. 30, 1917, approved by Acting Chief of Engineers v. 6, 1917. (ED 15927-553, Sec. MRC 1936-2179.)

Approved by Chief of Engineers, Feb. 9, 1918. (ED 15927-564, Sec. MRC 1936-2316.)

Approved by Acting Chief of Engineers, Feb. 9, 1918. (ED 15927-572, Sec. MRC 1936-2401.)

From first and second Mississippi River Commission district for use of marine ways and preparation for trial of dredge Delta and steamer Leota. (ED 104197-2251, Sec. MRC 1615-70.)

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                                         | Appropriation for maintenance and improvement of existing river and harbor works, act Oct. 2, 1914, allotment for— |                                                                     |                                  |              |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------|--------------|
|                                                                                                                                         | Mississippi River Commission.                                                                                      | Surveys, gauges, and observations.                                  | Dredges and dredging.            | Total.       |
| Amount expended on present project to end of last fiscal year.....                                                                      | \$29,991.18                                                                                                        | \$59,936.16                                                         | \$298,435.38                     | \$388,362.72 |
| Balance unexpended at end of last fiscal year.....                                                                                      | 8.82                                                                                                               | 63.84                                                               | 1,564.62                         | 1,637.28     |
|                                                                                                                                         | 8.82                                                                                                               | 63.84                                                               | 1,564.62                         | 1,637.28     |
| By transfer to allotment "Upper St. Francis levee district," first and second Mississippi River Commission districts <sup>1</sup> ..... | 8.82                                                                                                               | 63.84                                                               | 1,564.62                         | 1,637.28     |
|                                                                                                                                         | Appropriation for maintenance and improvement of existing river and harbor works, act Mar. 4, 1915, allotment for— |                                                                     |                                  |              |
|                                                                                                                                         | Mississippi River Commission.                                                                                      | Surveys, gauges, and observations.                                  | Dredges and dredging.            | Total.       |
| Amount expended on present project to end of last fiscal year.....                                                                      | \$39,760.11                                                                                                        | \$43,161.53                                                         | \$307,226.68                     | \$390,148.32 |
| Balance unexpended at end of last fiscal year.....                                                                                      | 239.89                                                                                                             | 16,839.26                                                           | 92,773.32                        | 109,852.47   |
|                                                                                                                                         | 239.89                                                                                                             | 16,839.26                                                           | 92,773.32                        | 109,852.47   |
| By transfer to allotment "Upper St. Francis levee district," first and second Mississippi River Commission districts <sup>1</sup> ..... | 239.89                                                                                                             | 16,839.26                                                           | 92,773.32                        | 109,852.47   |
|                                                                                                                                         | Appropriation for gauging waters of the Mississippi River and its tributaries.                                     | Works above Cairo.<br>[Appropriation: Improving Mississippi River.] |                                  |              |
|                                                                                                                                         |                                                                                                                    | Protection near Cairo. <sup>2</sup>                                 | Des Moines Rapids to Ohio River. | Total.       |
| Amount expended on present project to end of last fiscal year.....                                                                      | \$272,306.36                                                                                                       | \$50,000.00                                                         | \$687,632.53                     | \$737,632.53 |
| Balance unexpended at end of last fiscal year.....                                                                                      | <sup>3</sup> 915.52                                                                                                |                                                                     |                                  |              |
| Amount appropriated or allotted this fiscal year.....                                                                                   | 9,100.00                                                                                                           |                                                                     |                                  |              |
|                                                                                                                                         | 10,015.52                                                                                                          |                                                                     |                                  |              |
| Amount expended from beginning of present fiscal year to end of previous month.....                                                     | 7,496.89                                                                                                           |                                                                     |                                  |              |
| Amount expended during the month.....                                                                                                   | 720.96                                                                                                             |                                                                     |                                  |              |
|                                                                                                                                         | 8,217.85                                                                                                           |                                                                     |                                  |              |
| Balance unexpended at end of month.....                                                                                                 | 1,797.67                                                                                                           |                                                                     |                                  |              |
| In Treasury United States.....                                                                                                          | 900.00                                                                                                             |                                                                     |                                  |              |
| In hand.....                                                                                                                            | 897.67                                                                                                             |                                                                     |                                  |              |
|                                                                                                                                         | 1,797.67                                                                                                           |                                                                     |                                  |              |
| Outstanding liabilities at end of month.....                                                                                            | 1,797.67                                                                                                           |                                                                     |                                  |              |

<sup>1</sup> By resolution of the Mississippi River Commission Apr. 6, 1918, approved by Chief of Engineers A 15, 1918. (ED 15927-576, Sec. MRC 2051-12.)<sup>2</sup> Includes only work under act of July 5, 1884.

\$860.84 of the unexpended balance for 1917 reverted to Treasury Oct. 1, 1917.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                     | Funds contributed for flood control, Mississippi River (special fund). |                                                 |                                |                                                     |                                                   |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------|--------------------------------|-----------------------------------------------------|---------------------------------------------------|
|                                                                                     | Levees, Rock Island to New Boston, Ill.                                | Levees, Muscatine to mouth of Iowa River, Iowa. | Levees, Warsaw to Quincy, Ill. | Levees, mouth of Des Moines River to La Grange, Mo. | Levees, La Grange to mouth of Missouri River, Mo. |
| Amount appropriated or allotted this fiscal year.....                               | <sup>1</sup> \$27,500.00                                               | <sup>2</sup> \$15,000.00                        | <sup>3</sup> \$27,500.00       | <sup>4</sup> \$7,200.00                             | <sup>5</sup> \$33,000.00                          |
| Amount expended from beginning of present fiscal year to end of previous month..... | 31.67                                                                  | 38.36                                           | 14.20                          | 4,129.33                                            | 569.74                                            |
| Amount expended during the month.....                                               | 13.43                                                                  | 8.45                                            | .....                          | 1,255.45                                            | 1,862.87                                          |
|                                                                                     | 45.10                                                                  | 46.81                                           | 14.20                          | 5,384.78                                            | 2,432.61                                          |
| Balance unexpended at end of month..                                                | 27,454.90                                                              | 14,953.19                                       | 27,485.80                      | 1,815.22                                            | 30,567.39                                         |
| In Treasury United States.....                                                      | 10,000.00                                                              | 4,000.00                                        | 5,000.00                       | 200.00                                              | .....                                             |
| In other depositories.....                                                          | <sup>6</sup> 17,500.00                                                 | <sup>7</sup> 10,000.00                          | <sup>8</sup> 22,500.00         | .....                                               | <sup>9</sup> 28,000.00                            |
| In hand.....                                                                        | -45.10                                                                 | 953.19                                          | -14.20                         | 1,615.22                                            | 2,567.39                                          |
|                                                                                     | 27,454.90                                                              | 14,953.19                                       | 27,485.80                      | 1,815.22                                            | 30,567.39                                         |
| Outstanding liabilities at end of month.....                                        | .....                                                                  | 64.00                                           | 7.39                           | 5.19                                                | 878.23                                            |
| Amount covered by existing contracts at end of month.....                           | 25,383.33                                                              | 13,125.00                                       | .....                          | 1,582.90                                            | 24,943.55                                         |
|                                                                                     | 25,383.33                                                              | 13,189.00                                       | 7.39                           | 1,588.09                                            | 25,821.78                                         |
| Balance available at end of month.....                                              | 2,071.57                                                               | 1,764.19                                        | 27,478.41                      | 227.13                                              | 4,745.61                                          |

<sup>1</sup> Contributed by the Drury drainage district, Ill.

<sup>2</sup> Contributed by the Muscatine-Louisa Island levee district, Iowa, Mar. 14, 1918. (Sec. MRC 2461-21.)

<sup>3</sup> Contributed by the Hunt drainage district, Ill.

<sup>4</sup> Contributed by the Gregory drainage district, Mo., \$6,500 on Oct. 14, 1917 (Sec. MRC 2461-21), and \$700 on Apr. 18, 1918 (Sec. MRC 1936-2529).

<sup>5</sup> Contributed by the Riverland levee district, Mo., Dec. 8, 1917 (Sec. MRC 2461-21).

<sup>6</sup> On deposit with Hershey State Bank, Muscatine, Iowa, to credit of president, Mississippi River Commission.

<sup>7</sup> On deposit with First National Bank, Muscatine, Iowa, to credit of president, Mississippi River Commission.

<sup>8</sup> On deposit with Hill Dodge Bank, Warsaw, Ill., to credit of president, Mississippi River Commission.

<sup>9</sup> On deposit with Ayers National Bank, Jacksonville, Ill., to credit of president, Mississippi River Commission.

## Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.

## SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                            | Funds contributed for flood control, Mississippi River (special fund). |              | Expended appropriations. | Increase of compensation, rivers and harbors, 1918. | Grand total.   |
|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------|--------------------------|-----------------------------------------------------|----------------|
|                                                                                                                            | Levees, Grand Tower to Gale near Thebes, Ill.                          | Total.       |                          |                                                     |                |
| Amount expended on previous projects...                                                                                    |                                                                        |              |                          |                                                     | \$1,093,358.11 |
| Amount expended on present project to end of last fiscal year.....                                                         |                                                                        |              | <sup>1</sup> \$22,777.37 |                                                     | 11,128,635.32  |
| Balance unexpended at end of last fiscal year.....                                                                         |                                                                        |              |                          |                                                     | 590,575.16     |
| Amount appropriated or allotted this fiscal year.....                                                                      | <sup>2</sup> \$25,000.00                                               | \$135,200.00 |                          | <sup>3</sup> \$6,100.00                             | 1,066,400.00   |
| Receipts from sales, etc., this fiscal year:                                                                               |                                                                        |              |                          |                                                     |                |
| By transfer from allotment for levees, La Grange to mouth of Missouri River, Mo.....                                       |                                                                        |              |                          |                                                     | 2,146.28       |
| By transfer from allotment for levees, head of Chouteau Island to Prairie du Pont, Ill.....                                |                                                                        |              |                          |                                                     | 11,100.00      |
| Proceeds from rental of steamers Nokomis and Sachem.....                                                                   |                                                                        |              |                          |                                                     | 3,480.00       |
| Proceeds from rental of steamboat Leota.....                                                                               |                                                                        |              |                          |                                                     | 1,715.00       |
| Proceeds from docking steamer Eclipse.....                                                                                 |                                                                        |              |                          |                                                     | 842.90         |
| Collection of stoppage of pay of a United States employee.....                                                             |                                                                        |              |                          |                                                     | 19.33          |
| Reimbursement for coal furnished United States snag boat John N. Macomb.....                                               |                                                                        |              |                          |                                                     | 619.19         |
| Reimbursement for coal furnished first and second Mississippi River Commission districts.....                              |                                                                        |              |                          |                                                     | 26,798.04      |
| Received for rental, etc., of boats to first and second Mississippi River Commission districts.....                        |                                                                        |              |                          |                                                     | 3,753.81       |
| By transfer from allotment for levees, St. Louis to Cape Girardeau, Mo.....                                                |                                                                        |              |                          |                                                     | 25,000.00      |
| Do.....                                                                                                                    |                                                                        |              |                          |                                                     | 25,000.00      |
| By transfer from allotment for levees, Prairie du Pont to Grand Tower, Ill.....                                            |                                                                        |              |                          |                                                     | 55,000.00      |
| Reimbursement for use of marine ways, etc.....                                                                             |                                                                        |              |                          |                                                     | 382.99         |
| Received from sale of coal to Chicago & Eastern Illinois R. R.....                                                         |                                                                        |              |                          |                                                     | 271.19         |
| Reimbursement for rental of steamboat, etc., to first and second Mississippi River Commission districts <sup>4</sup> ..... |                                                                        |              |                          | 13.90                                               | 13.90          |
|                                                                                                                            | 25,000.00                                                              | 135,200.00   |                          | 6,113.90                                            | 1,813,117.79   |
| By transfer to allotment for levees, Rock Island to New Boston, Ill.....                                                   |                                                                        |              |                          |                                                     | 2,146.28       |
| By transfer to allotments for levees, Muscatine to mouth of Iowa River, Iowa, and Warsaw to Quincy, Ill.....               |                                                                        |              |                          |                                                     | 11,100.00      |
| By transfer to allotment for levees, Grand Tower to Gale near Thebes, Ill.....                                             |                                                                        |              |                          |                                                     | 25,000.00      |
| By transfer to allotment for levees, Warsaw to Quincy, Ill.....                                                            |                                                                        |              |                          |                                                     | 25,000.00      |
| By transfer to allotment for levees, Rock Island to New Boston, Ill.....                                                   |                                                                        |              |                          |                                                     | 55,000.00      |

<sup>1</sup> Waterway from Lockport, Ill., to St. Louis, Mo., \$22,291.23 (unexpended balance, \$3,802.17, of this appropriation carried to surplus fund June 30, 1909, under provisions of section 10 of sundry civil act of Mar. 4, 1909—(ED 46363-142, Sec. MRC 1125-9); claims for damages by collision, river and harbor works, \$486.14.

<sup>2</sup> Contributed by the East Cape Girardeau and Clear Creek drainage district, Ill., Feb. 4, 1918 (Sec. MRC 2461-21).

<sup>3</sup> Amount, \$5,100, previously reported increased \$1,000 in June, 1918.

<sup>4</sup> From first and second Mississippi River Commission district. (ED 104197-2251, Sec. MRC 1615-70.)

Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.

## SECRETARY, MISSISSIPPI RIVER COMMISSION—Continued.

|                                                                                                                                   | Funds contributed for<br>flood control, Missis-<br>sippi River (special<br>fund). |            | Expended<br>appropria-<br>tions. | Increase of<br>compensa-<br>tion, rivers<br>and har-<br>bors, 1918. | Grand total. |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------|----------------------------------|---------------------------------------------------------------------|--------------|
|                                                                                                                                   | Levees,<br>Grand<br>Tower to<br>Gale near<br>Thebes, Ill.                         | Total.     |                                  |                                                                     |              |
| Receipts from sales, etc., this fiscal year—<br>continued.                                                                        |                                                                                   |            |                                  |                                                                     |              |
| By transfer to allotment "Upper St.<br>Francis levee district" first and second<br>Mississippi River Commission<br>districts..... |                                                                                   |            |                                  |                                                                     | \$111,489.75 |
| Amount expended from beginning of pres-<br>ent fiscal year to end of previous month...                                            | \$13.63                                                                           | \$4,796.93 | .....                            | \$4,986.61                                                          | 533,101.84   |
| Amount expended during the month.....                                                                                             | 727.37                                                                            | 3,867.57   | .....                            | 404.49                                                              | 43,246.00    |
|                                                                                                                                   | 741.00                                                                            | 8,664.50   | .....                            | 5,391.10                                                            | 806,083.87   |
| Balance unexpended at end of<br>month.....                                                                                        | 24,259.00                                                                         | 126,535.50 | .....                            | 722.80                                                              | 1,007,033.92 |
| Treasury United States.....                                                                                                       | 5,000.00                                                                          | 24,200.00  | .....                            | 13.90                                                               | 807,518.39   |
| Other depositories.....                                                                                                           | 15,000.00                                                                         | 93,000.00  | .....                            |                                                                     | 93,000.00    |
| On hand.....                                                                                                                      | 4,259.00                                                                          | 9,335.50   | .....                            | 708.90                                                              | 106,515.53   |
|                                                                                                                                   | 24,259.00                                                                         | 126,535.50 | .....                            | 722.80                                                              | 1,007,033.92 |
| Outstanding liabilities at end of month...                                                                                        | 1,965.58                                                                          | 2,920.39   | .....                            | 87.46                                                               | 116,466.89   |
| Amount covered by existing contracts at<br>end of month.....                                                                      | 7,234.45                                                                          | 72,269.23  | .....                            |                                                                     | 274,212.51   |
|                                                                                                                                   | 9,200.03                                                                          | 75,189.62  | .....                            | 87.46                                                               | 390,679.40   |
| Balance available at end of month..                                                                                               | 15,058.97                                                                         | 51,345.88  | .....                            | 635.34                                                              | 616,354.52   |

<sup>1</sup> On deposit with Alexander County National Bank, Cairo, Ill., to credit of president, Mississippi River Commission.

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

FIRST AND SECOND DISTRICTS.

[ Appropriations: Mississippi River; flood control, Mississippi River, and Sacramento River, Cal.; funds contributed for flood control, Mississippi River; maintenance and improvement of existing river and harbor works; increase of compensation, rivers and harbors, 1918; funds contributed for improvement of Mississippi River; repairing Government levee at Walnut Bend, Ark.; emergencies in river and harbor works; examinations, surveys, and contingencies of rivers and harbors; rebuilding levees of the Mississippi River and tributaries damaged by floods; maintaining and protecting levees of Mississippi River and tributaries against floods; for claims for damages by collision, river and harbor works.]

|                                                                                     | Appropriation for Mississippi River, allotment for— |                                         |                                |                                |                        |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------|--------------------------------|--------------------------------|------------------------|
|                                                                                     | Upper<br>St. Francis<br>levee<br>district.          | Lower<br>St. Francis<br>levee district. | White River<br>levee district. | Reelfoot<br>levee<br>district. | Gayoso<br>Bend,<br>Mo. |
| Amount expended on present project to end of last fiscal year.....                  | \$820,300.00                                        | \$2,978,273.43                          | \$2,534,645.80                 | \$352,981.66                   | \$56,508.80            |
| Balance unexpended at end of last fiscal year.....                                  | 100,000.00                                          | 274,915.62                              | 100,000.00                     | 32,018.34                      | 93,491.40              |
| Amount appropriated or allotted since (net).....                                    |                                                     | .70                                     |                                |                                |                        |
|                                                                                     | 100,000.00                                          | 274,916.32                              | 100,000.00                     | 32,018.34                      | 93,491.40              |
| Amount expended from beginning of present fiscal year to end of previous month..... | 70,867.57                                           | 274,916.32                              | 100,000.00                     | 32,018.34                      | 93,491.40              |
| Amount expended during the month.....                                               | 9,089.84                                            |                                         |                                |                                |                        |
|                                                                                     | 79,957.41                                           | 274,916.32                              | 100,000.00                     | 32,018.34                      | 93,491.40              |
| Balance unexpended at end of month.....                                             | 20,042.59                                           |                                         |                                |                                |                        |
| In Treasury United States.....                                                      | 10,515.00                                           |                                         |                                |                                |                        |
| In hand.....                                                                        | 9,527.59                                            |                                         |                                |                                |                        |
|                                                                                     | 20,042.59                                           |                                         |                                |                                |                        |
| Amount covered by existing contracts at end of month.....                           | 20,042.59                                           |                                         |                                |                                |                        |

|                                                                                     | Appropriation for Mississippi River, allotment for— |                  |                        |                   |                      |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|------------------|------------------------|-------------------|----------------------|
|                                                                                     | Barfield,<br>Ark.                                   | Osceola,<br>Ark. | Bullerton<br>Bar, Ark. | Norfolk,<br>Miss. | Porter<br>Lake, Ark. |
| Amount expended on present project to end of last fiscal year.....                  | \$149,729.03                                        |                  | \$65,242.68            |                   | \$364,382.00         |
| Balance unexpended at end of last fiscal year.....                                  | 50,270.97                                           | \$25,000.00      | 4,757.32               | \$40,000.00       | 70,546.00            |
| Amount expended from beginning of present fiscal year to end of previous month..... | 50,270.97                                           |                  | 3,729.02               | 13,818.29         | 70,546.00            |
| Amount expended during the month.....                                               |                                                     |                  | 1,028.30               | 4,974.24          |                      |
|                                                                                     | 50,270.97                                           |                  | 4,757.32               | 18,792.53         | 70,546.00            |
| Balance unexpended at end of month.....                                             |                                                     | 25,000.00        |                        | 21,207.47         |                      |
| In Treasury United States.....                                                      |                                                     | 25,000.00        |                        | 15,000.00         |                      |
| In hand.....                                                                        |                                                     |                  |                        | 6,207.47          |                      |
|                                                                                     |                                                     | 25,000.00        |                        | 21,207.47         |                      |
| Outstanding liabilities at end of month.....                                        |                                                     |                  |                        | 13,500.00         |                      |
| Balance available at end of month.....                                              |                                                     | 25,000.00        |                        | 7,707.47          |                      |

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

## FIRST AND SECOND DISTRICTS—Continued.

|                                                                                     | Appropriation for Mississippi River, allotment for— |                        |                                   |                       |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------|-----------------------------------|-----------------------|
|                                                                                     | Helena,<br>Ark.                                     | Old Town<br>Bend, Ark. | General<br>repairs,<br>and stone. | Plant.                |
| Amount expended on present project to end of last fiscal year.....                  | \$296,459.40                                        | \$437,658.18           | \$4,028.50                        | \$1,888,795.96        |
| Balance unexpended at end of last fiscal year.....                                  | 5,170.42                                            | 26,822.32              | 45,971.50                         | 26,344.19             |
| Amount appropriated or allotted since (net).....                                    |                                                     |                        |                                   | <sup>1</sup> 1,444.66 |
|                                                                                     | 5,170.42                                            | 26,822.32              | 45,971.50                         | 27,788.85             |
| Amount expended from beginning of present fiscal year to end of previous month..... | 649.27                                              | 26,822.32              | 45,971.50                         | 26,644.19             |
| Amount expended during the month.....                                               | .50                                                 |                        |                                   |                       |
|                                                                                     | 649.77                                              | 26,822.32              | <sup>2</sup> 45,971.50            | 26,644.19             |
| Balance unexpended at end of month.....                                             | 4,520.65                                            |                        |                                   | 1,144.66              |
| In Treasury United States.....                                                      | 4,500.00                                            |                        |                                   | 1,144.66              |
| In hand.....                                                                        | 20.65                                               |                        |                                   |                       |
|                                                                                     | 4,520.65                                            |                        |                                   | 1,144.66              |
| Balance available at end of month.....                                              | 4,520.65                                            |                        |                                   | 1,144.66              |

|                                                                                     | Appropriation for Mississippi River, allotment for— |                    |                              |                 |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------|------------------------------|-----------------|
|                                                                                     | New plant.                                          | Memphis<br>Harbor. | Expended<br>allotments.      | Total.          |
| Amount expended on present project to end of last fiscal year.....                  | \$734,686.80                                        | \$21,107.77        | <sup>3</sup> \$11,620,698.33 | \$22,325,498.35 |
| Balance unexpended at end of last fiscal year.....                                  | 181,791.91                                          | 4,892.23           |                              | 1,081,992.60    |
| Amount appropriated or allotted since (net).....                                    |                                                     |                    |                              | 1,445.36        |
|                                                                                     | 181,791.91                                          | 4,892.23           |                              | 1,083,437.96    |
| Amount expended from beginning of present fiscal year to end of previous month..... | 104,945.35                                          | 4,892.23           |                              | 919,583.15      |
| Amount expended during the month.....                                               | 29,009.04                                           |                    |                              | 44,101.92       |
|                                                                                     | 133,954.39                                          | 4,892.23           |                              | 963,685.07      |
| Balance unexpended at end of month.....                                             | 47,837.52                                           |                    |                              | 119,752.89      |
| In Treasury United States.....                                                      | 41,873.92                                           |                    |                              | 98,033.58       |
| In hand.....                                                                        | 5,963.60                                            |                    |                              | 21,719.31       |
|                                                                                     | 47,837.52                                           |                    |                              | 119,752.89      |
| Outstanding liabilities at end of month.....                                        | 45,000.00                                           |                    |                              | 58,500.00       |
| Amount covered by existing contracts at end of month.....                           | 2,837.52                                            |                    |                              | 22,880.11       |
|                                                                                     | 47,837.52                                           |                    |                              | 81,380.11       |
| Balance available at end of month.....                                              |                                                     |                    |                              | 38,372.78       |

<sup>1</sup>Amount \$300, previously reported increased \$1,144.66 received from New Orleans district for rental of barges.

<sup>2</sup>Distributed as follows: Hopefield Bend, Ark., \$8,719.83; Memphis Harbor, \$3,069.70; Norfolk, Miss., \$1,845.05; Porter Lake, Ark., \$6,835.91; Trotters Point, Miss., \$1,497.84; Old Town Bend, Ark., \$24,003.17.

<sup>3</sup>Upper Yazoo levee district, \$1,468,703.45; Walnut Bend levee, preservation of works at, \$28,200; preservation of works (levees), \$17,909; preservation of works (revetment and contraction works, permanent channel improvement and protection), \$36,958.89; Slough Landing Neck, Tenn., \$206,385.36; chute of Island 26 (abatis dikes), \$1,478.11; Plum Point Reach, \$5,591,629.22; removal of Nonconah Rock, \$9,000; Golden Lake, Ark., \$91,193.91; Walnut Bend, Ark., \$346,309.92; Trotters Point, Miss., \$99,688.10; Sunflower, Miss., \$253,365.56; stone, \$134,803.80; dredges and dredging, \$388,097.12; experimental dikes, \$54,924.42; Columbus, Ky., \$43,750; at Hickman, Ky., \$95,132; at New Madrid, Mo., \$153,000; at Caruthersville, Mo., \$80,314.37; at Memphis, Tenn., \$45,000; improving harbor at Memphis, Tenn., \$1,429,244.94; improving harbor at Memphis, Tenn. (Wolf River), \$45,000; at Memphis, Tenn. (Wolf River), \$25,786; Hopefield Bend (preservation of works at), \$698,361.20; improving St. Francis River (Walnut Bend levee), \$75,000; survey east bank Mississippi River, Bessie to Memphis, Tenn., \$11,000; Star Landing, Miss., \$16,611.69; Delta, Miss., \$965.24; surveys, \$162,886.03; Wolf River, \$10,000.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## FIRST AND SECOND DISTRICTS—Continued.

|                                                                                     | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                                   |                                   |                             |                          |                  |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------|--------------------------|------------------|
|                                                                                     | Surveys.                                                                                       | Upper St. Francis levee district. | Lower St. Francis levee district. | White River levee district. | Reelfoot levee district. | Gayoso Bend, Mo. |
| Amount appropriated or allotted since (net).....                                    | \$5,000.00                                                                                     | \$90,000.00                       | \$450,000.00                      | \$110,000.00                | \$10,000.00              | \$50,000.00      |
| Amount expended from beginning of present fiscal year to end of previous month..... | 5,000.00                                                                                       |                                   | 119,505.29                        | 85,134.54                   | 10,000.00                | 30,718.60        |
| Amount expended during the month.....                                               |                                                                                                |                                   | 36,860.61                         | 1,354.77                    |                          | 5,803.93         |
|                                                                                     | 5,000.00                                                                                       |                                   | 156,365.90                        | 86,489.31                   | 10,000.00                | 36,522.53        |
| Balance unexpended at end of month.....                                             |                                                                                                | 90,000.00                         | 293,634.10                        | 23,510.69                   |                          | 13,477.47        |
| In Treasury United States.....                                                      |                                                                                                | 90,000.00                         | 302,935.10                        | 5,241.67                    |                          |                  |
| In hand.....                                                                        |                                                                                                |                                   | -9,301.00                         | 18,269.02                   |                          | 13,477.47        |
|                                                                                     |                                                                                                | 90,000.00                         | 293,634.10                        | 23,510.69                   |                          | 13,477.47        |
| Outstanding liabilities at end of month.....                                        |                                                                                                | 500.00                            | 2,000.00                          | 500.00                      |                          | 4,200.00         |
| Amount covered by existing contracts at end of month.....                           |                                                                                                | 78,000.00                         | 290,000.00                        | 7,000.00                    |                          |                  |
|                                                                                     |                                                                                                | 78,500.00                         | 292,000.00                        | 7,500.00                    |                          | 4,200.00         |
| Balance available at end of month.....                                              |                                                                                                | 11,500.00                         | 1,634.10                          | 16,010.69                   |                          | 9,277.47         |

|                                                                                     | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotment for— |               |                    |                   |                     |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------|--------------------|-------------------|---------------------|
|                                                                                     | Barfield, Ark.                                                                                 | Osceola, Ark. | Star Landing Miss. | Porter Lake, Ark. | Old Town Bend, Ark. |
| Amount appropriated or allotted since (net)....                                     | \$100,000.00                                                                                   | \$45,000.00   | (1)                | \$130,000.00      | \$40,000.00         |
| Amount expended from beginning of present fiscal year to end of previous month..... | 77,875.05                                                                                      | 31,541.01     |                    | 85,570.02         | 40,000.00           |
| Amount expended during the month.....                                               | 1,395.00                                                                                       |               |                    | 19,759.67         |                     |
|                                                                                     | 79,270.05                                                                                      | 31,541.01     |                    | 105,329.69        | 40,000.00           |
| Balance unexpended at end of month....                                              | 20,729.95                                                                                      | 13,458.99     |                    | 24,670.31         |                     |
| In Treasury United States.....                                                      | 20,573.16                                                                                      | 8,658.99      |                    | 2,064.20          |                     |
| In hand.....                                                                        | 156.79                                                                                         | 4,800.00      |                    | 22,606.11         |                     |
|                                                                                     | 20,729.95                                                                                      | 13,458.99     |                    | 24,670.31         |                     |
| Outstanding liabilities at end of month.....                                        | 1,000.00                                                                                       |               |                    | 7,000.00          |                     |
| Balance available at end of month.....                                              | 19,729.95                                                                                      | 13,458.99     |                    | 17,670.31         |                     |

<sup>1</sup> Amount, \$120,000, previously reported transferred to lower Yazoo levee district, third Mississippi River district, as of June 12, 1917, by resolution of Mississippi River Commission, Nov. 20, 1917, approved by Chief of Engineers, Nov. 26, 1917. (ED 15927-558.)

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

**FIRST AND SECOND DISTRICTS—Continued.**

|                                                                                     | Appropriation for flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                          |              |                           |                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------|--------------|---------------------------|----------------|
|                                                                                     | General repairs, and stone.                                                                    | Plant.                   | New plant.   | Memphis Harbor.           | Total.         |
| Amount appropriated or allotted since (net).....                                    | \$35,000.00                                                                                    | <sup>1</sup> \$77,626.39 | \$128,000.00 | <sup>2</sup> \$250,000.00 | \$1,520,626.39 |
| Amount expended from beginning of present fiscal year to end of previous month..... | 34,435.47                                                                                      | 63,388.24                |              | <sup>3</sup> 145,730.25   | 728,898.47     |
| Amount expended during the month.....                                               | 564.53                                                                                         | 12,727.90                |              | <sup>4</sup> 38,243.07    | 116,709.48     |
|                                                                                     | <sup>5</sup> 35,000.00                                                                         | 76,116.14                |              | 183,973.32                | 845,607.95     |
| Balance unexpended at end of month.....                                             |                                                                                                | 1,510.25                 | 128,000.00   | 66,026.68                 | 675,018.44     |
| In Treasury United States.....                                                      | 564.53                                                                                         | 1,485.00                 | 128,000.00   | 65,896.24                 | 625,418.89     |
| In hand.....                                                                        | -564.53                                                                                        | 25.25                    |              | 130.44                    | 49,599.55      |
|                                                                                     |                                                                                                | 1,510.25                 | 128,000.00   | 66,026.68                 | 675,018.44     |
| Outstanding liabilities at end of month.....                                        |                                                                                                | 1,510.25                 |              | 28,000.00                 | 44,710.25      |
| Amount covered by existing contracts at end of month.....                           |                                                                                                |                          | 20,600.00    |                           | 395,600.00     |
|                                                                                     |                                                                                                | 1,510.25                 | 20,600.00    | 28,000.00                 | 440,310.25     |
| Balance available at end of month.....                                              |                                                                                                |                          | 107,400.00   | 38,026.68                 | 234,708.19     |

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for— |                                                  |                            |                           |                |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------|---------------------------|----------------|
|                                                                                     | Upper St. Francis levee district.                                                                   | Watson Point, Ky. (dike at Slough Landing Neck). | General repairs and stone. | Expended allotments       | Total.         |
| Amount expended on present project to end of last fiscal year.....                  | \$100,000.00                                                                                        | \$112,557.06                                     | ( <sup>6</sup> )           | <sup>7</sup> \$981,028.86 | \$1,193,585.92 |
| Balance unexpended at end of last fiscal year.....                                  | 1,637.28                                                                                            | 442.94                                           |                            |                           | 2,080.22       |
| Amount expended from beginning of present fiscal year to end of previous month..... |                                                                                                     | 442.94                                           |                            |                           | 442.94         |
| Balance unexpended at end of month.....                                             | 1,637.28                                                                                            |                                                  |                            |                           | 1,637.28       |
| In Treasury United States.....                                                      | 1,637.28                                                                                            |                                                  |                            |                           | 1,637.28       |
| Balance available at end of month.....                                              | 1,637.28                                                                                            |                                                  |                            |                           | 1,637.28       |

<sup>1</sup> Amount, \$76,141.39, previously reported increased \$1,485, account amount received from Vicksburg, Miss., engineer district, for rent of plant.

<sup>2</sup> Amount, \$184,000, previously reported increased \$66,000, account allotment by Mississippi River Commission from appropriation by sundry civil act, approved June 12, 1917. Approved by Chief of Engineers, June 26, 1918. (ED 15927-582.)

<sup>3</sup> Amount, \$145,780.34, previously reported decreased \$50.09, account reimbursement from appropriation "Pay, etc., of the Army" covering pay of engineer officer for part of months of August and September, 1917, payable by appropriation named.

<sup>4</sup> Includes \$153.85 (transferred in Office Chief of Engineers to allotment for "Dredges and dredging") in settlement for value of coal received by transfer from office, Secretary, Mississippi River Commission.

<sup>5</sup> Distributed as follows: Watsons Point, dike at Slough Landing Neck, \$55.88; Memphis Harbor, \$3,559.77; Hopefield Bend, Ark., \$1,027.89; Star Landing, Miss., \$373.46; Porter Lake, Ark., \$6,805.80; Trotters Point, Miss., \$9,381.98; Delta, Miss., \$821.17; Old Town Bend, Ark., \$7,107.25; Stone (undistributed), \$1,645.80, salvage of war materials (reimbursable), \$4,221.

<sup>6</sup> Total expenditures (\$60,000) under this allotment to end of fiscal year 1917, have been distributed to following works: Slough Landing Neck, Tenn., \$16,498.17; Plum Point reach \$1,260; Star Landing, Miss., \$1,724.54; Trotters Point, Miss., \$2,376.36; Delta, Miss., \$20,257.67; Old Town Bend, Ark., \$2,687.65; Sunflower, Miss., \$13.83; plant (repairs), \$13,607.43; stone, \$1,574.35.

<sup>7</sup> Surveys, \$1,500; Slough Landing Neck, Tenn., \$191,498.17; Lower St. Francis levee district, \$437,000; White River levee district, \$160,000; Plum Point reach, \$1,260; Star Landing, Miss., \$106,724.54; Trotters Point, Miss., \$2,376.36; Delta, Miss., \$20,257.67; Old Town Bend, Ark., \$2,687.65; Sunflower, Miss., \$13.83; plant (repairs), \$53,636.29; experimental revetment, \$2,500; stone, \$1,574.35.

## Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.

## FIRST AND SECOND DISTRICTS—Continued.

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for— |                                   |                             |                            |                          |                            |             |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------|----------------------------|--------------------------|----------------------------|-------------|
|                                                                                     | Upper St. Francis levee district.                                                                   | Lower St. Francis levee district. | White River levee district. | Slough Landing Neck, Tenn. | Delta, Miss.             | General repairs and stone. | New plant.  |
| Amount expended on present project to end of last fiscal year.....                  | \$40,811.09                                                                                         | \$314,999.69                      | \$136,758.24                | \$191,241.75               | \$94,590.12 <sup>1</sup> | \$49,985.00                | \$40,000.00 |
| Balance unexpended at end of last fiscal year.....                                  | 192,567.10                                                                                          | .96                               | 23,242.21                   | 493.69                     | 215.75                   | 15.00                      | 15,000.00   |
| Amount appropriated or allotted since (net).....                                    |                                                                                                     |                                   | 102.55                      |                            |                          |                            |             |
|                                                                                     | 192,567.10                                                                                          | .96                               | 23,344.76                   | 493.69                     | 215.75                   | 15.00                      | 15,000.00   |
| Amount expended from beginning of present fiscal year to end of previous month..... | 24,188.91                                                                                           | .96                               | 23,344.76                   | 493.69                     | 215.75                   | 15.00                      | .....       |
| Amount expended during the month.....                                               |                                                                                                     |                                   |                             |                            |                          |                            | 15,000.00   |
|                                                                                     | 24,188.91                                                                                           | .96                               | 23,344.76                   | 493.69                     | 215.75                   | <sup>2</sup> 15.00         | 15,000.00   |
| Balance unexpended at end of month.....                                             | 168,378.19                                                                                          |                                   |                             |                            |                          |                            | .....       |
| In Treasury United States..                                                         | 161,625.45                                                                                          |                                   |                             |                            |                          |                            | .....       |
| In hand.....                                                                        | 6,752.74                                                                                            |                                   |                             |                            |                          |                            | .....       |
|                                                                                     | 168,378.19                                                                                          |                                   |                             |                            |                          |                            | .....       |
| Outstanding liabilities at end of month.....                                        | 148,000.00                                                                                          |                                   |                             |                            |                          |                            | .....       |
| Balance available at end of month.....                                              | 20,378.19                                                                                           |                                   |                             |                            |                          |                            | .....       |

<sup>1</sup> Total expenditures (\$49,985) under this allotment to end of fiscal year 1917, have been distributed to following works: Slough Landing Neck, Tenn., \$535.30; Barfield, Ark., \$1,545.98; Plum Point reach, \$20,041.39; Hopefield Bend (preservation of works at), \$7,296.03; Star Landing, Miss., \$8,840.62; Sunflower, Miss., \$172.50; plant (repairs), \$9,979.81; stone, \$1,573.37.

<sup>2</sup> Distributed as follows: Trotters Point, Miss., \$15.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## FIRST AND SECOND DISTRICTS—Continued.

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works, act of Mar. 4, 1915, allotment for— |                 |                           |                | Funds contributed for improvement of Mississippi River (special fund). |                   |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------|---------------------------|----------------|------------------------------------------------------------------------|-------------------|
|                                                                                     | Experimental re-vestment.                                                                           | Memphis Harbor. | Expended allotments.      | Total.         | In upper St. Francis levee district.                                   | At Norfolk, Miss. |
| Amount expended on present project to end of last fiscal year.....                  | \$22,170.73                                                                                         |                 | <sup>1</sup> \$233,000.00 | \$1,123,556.62 | \$26,734.69                                                            |                   |
| Balance unexpended at end of last fiscal year.....                                  | 30.66                                                                                               | \$25,000.00     |                           | 256,565.37     | 207,265.31                                                             |                   |
| Amount appropriated or allotted since (net).....                                    |                                                                                                     |                 |                           | 102.55         |                                                                        | \$50,000.00       |
|                                                                                     | 30.66                                                                                               | 25,000.00       |                           | 256,667.92     | 207,265.31                                                             | 50,000.00         |
| Amount expended from beginning of present fiscal year to end of previous month..... | 30.66                                                                                               | 25,000.00       |                           | 73,289.73      | 62,580.62                                                              | 50,000.00         |
| Amount expended during the month.....                                               |                                                                                                     |                 |                           | 15,000.00      | 16,338.69                                                              |                   |
|                                                                                     | 30.66                                                                                               | 25,000.00       |                           | 88,289.73      | 78,919.31                                                              | 50,000.00         |
| Balance unexpended at end of month.....                                             |                                                                                                     |                 |                           | 168,378.19     | 128,346.00                                                             |                   |
| In Treasury United States.....                                                      |                                                                                                     |                 |                           | 161,625.45     | 105,000.00                                                             |                   |
| In hand.....                                                                        |                                                                                                     |                 |                           | 6,752.74       | 23,346.00                                                              |                   |
|                                                                                     |                                                                                                     |                 |                           | 168,378.19     | 128,346.00                                                             |                   |
| Outstanding liabilities at end of month.....                                        |                                                                                                     |                 |                           | 148,000.00     |                                                                        |                   |
| Amount covered by existing contracts at end of month.....                           |                                                                                                     |                 |                           |                | 128,346.00                                                             |                   |
| Balance available at end of month.....                                              |                                                                                                     |                 |                           | 20,378.19      |                                                                        |                   |

| Appropriations.                                                                     | Funds contributed for flood control, Mississippi River (special fund). |                                   |                             |              |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------|-----------------------------|--------------|
|                                                                                     | Upper St. Francis levee district.                                      | Lower St. Francis levee district. | White River levee district. | Total.       |
| Amount appropriated or allotted since last fiscal year (net).....                   | \$45,000.00                                                            | \$247,500.00                      | \$55,000.00                 | \$347,500.00 |
| Amount expended from beginning of present fiscal year to end of previous month..... |                                                                        |                                   | 9,064.44                    | 9,064.44     |
| Amount expended during the month.....                                               |                                                                        |                                   | 21,135.92                   | 21,135.92    |
|                                                                                     |                                                                        |                                   | 30,200.36                   | 30,200.36    |
| Balance unexpended at end of month.....                                             | 45,000.00                                                              | 247,500.00                        | 24,799.64                   | 317,299.64   |
| In Treasury United States.....                                                      | 45,000.00                                                              | 225,500.00                        | 15,000.00                   | 285,500.00   |
| In hand.....                                                                        |                                                                        | 22,000.00                         | 9,799.64                    | 31,799.64    |
|                                                                                     | 45,000.00                                                              | 247,500.00                        | 24,799.64                   | 317,299.64   |
| Amount covered by existing contracts at end of month.....                           | 45,000.00                                                              | 247,500.00                        | 24,799.64                   | 317,299.64   |
|                                                                                     | 45,000.00                                                              | 247,500.00                        | 24,799.64                   | 317,299.64   |

<sup>1</sup> Surveys, \$3,000; Plum Point reach, \$155,000; plant, \$75,000.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918.—Continued.*

## FIRST AND SECOND DISTRICTS—Continued.

| Appropriations.                                                                     | Expended appropriations.  | Expended contributed funds (improving Mississippi River). | Expended contributed funds (flood control act). | Increase of compensation, rivers and harbors, 1918. | Grand total. |
|-------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|--------------|
| Amount expended on present project to end of last fiscal year.....                  | <sup>1</sup> \$823,058.97 | <sup>2</sup> \$654,066.61                                 | <sup>3</sup> \$5,000.00                         | .....                                               | \$26,151,50  |
| Balance unexpended at end of last fiscal year.....                                  | .....                     | .....                                                     | .....                                           | .....                                               | 1,547,90     |
| Amount appropriated or allotted since last fiscal year (net).....                   | .....                     | .....                                                     | .....                                           | \$8,000.00                                          | 1,927,67     |
| .....                                                                               | .....                     | .....                                                     | .....                                           | 8,000.00                                            | 3,475,57     |
| Amount expended from beginning of present fiscal year to end of previous month..... | .....                     | .....                                                     | .....                                           | 6,308.52                                            | 1,850,16     |
| Amount expended during the month.....                                               | .....                     | .....                                                     | .....                                           | 1,243.06                                            | 214,52       |
| .....                                                                               | .....                     | .....                                                     | .....                                           | 7,551.58                                            | 2,064,69     |
| Balance unexpended at end of month.....                                             | .....                     | .....                                                     | .....                                           | 448.42                                              | 1,410,88     |
| In Treasury United States.....                                                      | .....                     | .....                                                     | .....                                           | .....                                               | 1,277,21     |
| In hand.....                                                                        | .....                     | .....                                                     | .....                                           | 448.42                                              | 133,66       |
| .....                                                                               | .....                     | .....                                                     | .....                                           | 448.42                                              | 1,410,88     |
| Outstanding liabilities at end of month.....                                        | .....                     | .....                                                     | .....                                           | .....                                               | 251,210      |
| Amount covered by existing contracts at end of month.....                           | .....                     | .....                                                     | .....                                           | .....                                               | 864,12       |
| .....                                                                               | .....                     | .....                                                     | .....                                           | .....                                               | 1,115,330    |
| Balance available at end of month.....                                              | .....                     | .....                                                     | .....                                           | 448.42                                              | 295,54       |

<sup>1</sup> Repairing Government levee at Walnut Bend, Ark., \$90,000; emergencies in river and harbor works (for Wolf River), \$8,000; examinations, surveys, and contingencies of rivers and harbors, \$485; rebuilding levees of the Mississippi River and tributaries damaged by floods, \$620,000; maintaining and protecting levees of Mississippi River and tributaries against floods, \$104,558.97; for claims for damages by collision river and harbor works, \$15.

<sup>2</sup> For improvement of Mississippi River as follows: At Trotters Point, Miss., \$100,000; near Memphis, Tenn., \$1,066.61; near Laconia Circle, Ark., \$8,000; at Star Landing Bend, Miss., \$210,000; at Delta, Miss., \$160,000; Reelfoot levee district in Kentucky, \$25,000; at Gayoso Bend, Mo., \$150,000.

<sup>3</sup> Contributed by the Fulton County Levee Board, Hickman, Ky., for the Reelfoot levee district, Kentucky.

*Consolidated statement of conditions of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## THIRD DISTRICT.

Appropriations: Mississippi River; flood control, Mississippi River, and Sacramento River, Cal.; funds contributed for flood control, Mississippi River; maintenance and improvement of existing river and harbor works; increase of compensation, rivers and harbors, 1918; funds contributed for improvement of Mississippi River; maintaining and protecting levees of the Mississippi River and tributaries against floods; rebuilding levees of the Mississippi River and tributaries damaged by floods; examinations, surveys and contingencies of rivers and harbors.]

|                                                                                     | Appropriation for Mississippi River, allotment for— |                                       |                                      |                                    |                            |                            |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------|--------------------------------------|------------------------------------|----------------------------|----------------------------|
|                                                                                     | Surveys,<br>third<br>district.                      | Upper<br>Tensas<br>levee<br>district. | Lower<br>Yazoo<br>levee<br>district. | Lake<br>Bolivar<br>Front,<br>Miss. | Ashbrook<br>Neck,<br>Miss. | Ashbrook<br>Dike,<br>Miss. |
| Amount expended on present project to end of last fiscal year.....                  | \$151,456.53                                        | \$6,980,442.44                        | \$5,823,718.96                       | \$391,387.15                       | \$804,424.08               | \$97,673.13                |
| Balance unexpended at end of last fiscal year.....                                  | 5,000.00                                            | 303,454.05                            | 54,996.85                            | 3,862.45                           | 38,345.62                  | 144,326.87                 |
| Amount expended from beginning of present fiscal year to end of previous month..... | 5,000.00                                            | 163,712.90                            | 40,472.43                            | .....                              | 38,345.62                  | 127,658.14                 |
| Amount expended during the month.....                                               | .....                                               | <sup>1</sup> 9,173.74                 | .....                                | .....                              | .....                      | <sup>2</sup> 4,493.91      |
|                                                                                     | 5,000.00                                            | 172,886.64                            | 40,472.43                            | .....                              | 38,345.62                  | 132,152.05                 |
| Balance unexpended at end of month.....                                             | .....                                               | 130,567.41                            | 14,524.42                            | 3,862.45                           | .....                      | 12,174.82                  |
| On Treasury United States.....                                                      | .....                                               | 97,541.51                             | 9,371.19                             | 1,418.76                           | .....                      | 10,036.90                  |
| On hand.....                                                                        | .....                                               | 33,025.90                             | 5,153.23                             | 2,443.69                           | .....                      | 2,137.92                   |
|                                                                                     | .....                                               | 130,567.41                            | 14,524.42                            | 3,862.45                           | .....                      | 12,174.82                  |
| Outstanding liabilities at end of month.....                                        | .....                                               | 3,460.27                              | .....                                | 2,047.82                           | .....                      | 4,343.53                   |
| Amount covered by existing contracts at end of month.....                           | .....                                               | 114,017.26                            | 14,524.42                            | .....                              | .....                      | .....                      |
|                                                                                     | .....                                               | 117,477.53                            | 14,524.42                            | 2,047.82                           | .....                      | 4,343.53                   |
| Balance available at end of month.....                                              | .....                                               | 13,089.88                             | .....                                | 1,814.63                           | .....                      | 7,831.20                   |

|                                                                                     | Appropriation for Mississippi River, allotment for— |                           |                           |                     |                                |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------|---------------------------|---------------------|--------------------------------|
|                                                                                     | Panther<br>Forest,<br>Ark.                          | Fitlers<br>Bend,<br>Miss. | Cotton-<br>wood,<br>Miss. | Vicksburg,<br>Miss. | Reid-Bed-<br>ford Bend,<br>La. |
| Amount expended on present project to end of last fiscal year.....                  | \$310,110.59                                        | \$389,641.25              | \$214,376.17              | \$512,647.13        | \$336,488.09                   |
| Balance unexpended at end of last fiscal year.....                                  | 26,623.94                                           | 192.26                    | 5,633.83                  | 30,077.64           | 43,585.95                      |
| Amount expended from beginning of present fiscal year to end of previous month..... | 26,623.94                                           | 192.26                    | 5,633.83                  | 30,077.64           | 43,585.95                      |
|                                                                                     | 26,623.94                                           | 192.26                    | 5,633.83                  | 30,077.64           | 43,585.95                      |

<sup>1</sup> Includes \$269.19 in Treasury settlement No. 32388, for freight service.

<sup>2</sup> Includes \$3.78 in Treasury settlement No. 31762, and \$522.50 in Treasury settlement No. 32124, for freight service.

Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.

## THIRD DISTRICT—Continued.

|                                                                                  | Appropriation for Mississippi River, allotment for— |                                                |                       |                             |                |
|----------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------|-----------------------|-----------------------------|----------------|
|                                                                                  | Red Fork,<br>Ark.                                   | Repairs to<br>existing<br>works, and<br>stone. | Plant.                | Expended<br>allotments.     | Total.         |
| Amount expended on present project to end of last fiscal year.....               | \$67,948.93                                         | (1)                                            | \$2,494,596.00        | <sup>2</sup> \$7,910,505.99 | \$26,485,416.4 |
| Balance unexpended at end of last fiscal year.....                               | 12,026.07                                           | \$45,991.17                                    | 124,942.65            | .....                       | 839,059.3      |
| Amount appropriated or allotted since (net).....                                 | .....                                               | .....                                          | <sup>3</sup> 9,574.97 | .....                       | 9,574.9        |
| .....                                                                            | 12,026.07                                           | 45,991.17                                      | 134,517.62            | .....                       | 848,634.2      |
| Amount expended from beginning of present fiscal year to end previous month..... | 12,026.07                                           | 45,991.17                                      | 89,094.33             | .....                       | 628,414.2      |
| Amount expended during the month.....                                            | .....                                               | .....                                          | 28,913.04             | .....                       | 42,580.0       |
| .....                                                                            | 12,026.07                                           | <sup>4</sup> 45,991.17                         | 118,007.37            | .....                       | 670,994.9      |
| Balance unexpended at end of month.....                                          | .....                                               | .....                                          | 16,510.25             | .....                       | 177,639.3      |
| In Treasury United States.....                                                   | .....                                               | .....                                          | 27,888.27             | .....                       | 146,256.0      |
| In hand.....                                                                     | .....                                               | .....                                          | —11,378.02            | .....                       | 31,382.7       |
| .....                                                                            | .....                                               | .....                                          | 16,510.25             | .....                       | 177,639.3      |
| Outstanding liabilities at end of month.....                                     | .....                                               | .....                                          | 16,510.25             | .....                       | 26,361.8       |
| Amount covered by existing contracts at end of month.....                        | .....                                               | .....                                          | .....                 | .....                       | 128,541.0      |
| .....                                                                            | .....                                               | .....                                          | 16,510.25             | .....                       | 154,903.5      |
| Balance available at end of month.....                                           | .....                                               | .....                                          | .....                 | .....                       | 22,735.8       |

<sup>1</sup> Amount (\$54,033.83) expended during fiscal year 1917, distributed to following works: Fitlers Bend \$45,379.07; Greenville, Miss., \$877.91; Vaulcluse, Ark., \$1,509.96; Albemarle Bend, \$7.35; stone, third district \$6,259.54.

<sup>2</sup> Longwood, Miss., \$157,010.28; Lake Providence Reach, \$3,936,957.46; stone, third district, \$510,208.72; Vaulcluse, Ark., \$155,027.13; Leland Neck, Ark., \$198,850.72; survey east bank Mississippi River, Brunswick to Warrenton, Miss., \$6,936.59; Beulah Crevasse, \$550,000; Arkansas River levees, \$50,000; Albemarle Bend \$594,826.49; Grand Lake, Ark., \$159,456.47; Greenville, Miss., \$1,290,679.79; Delta Point, La., \$255,173.22; Fitlers Bend, \$45,379.07.

<sup>3</sup> Amount (\$5,818.66) previously reported increased \$3,756.31, account \$2,923.72 received from New Orleans, La., district for rental of plant; \$702.59 received from Vicksburg, Miss., district for rental of plant and \$130 received from fourth Mississippi River Commission district for rental of plant.

<sup>4</sup> Distributed as follows: Panther Forest, Ark., \$14,072.67; Fitlers Bend, Miss., \$13,466.12; Cottonwood Miss., \$5,571.41; Red Fork, Ark., \$9,490.16; Greenville, Miss., \$4; and stone, third district, \$3,386.81.

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

## THIRD DISTRICT—Continued.

| Appropriations.                                                                     | Flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                                      |                                      |                           |                            |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|---------------------------|----------------------------|
|                                                                                     | Surveys,<br>third<br>district.                                               | Upper Ten-<br>sas levee<br>district. | Lower<br>Yazoo<br>levee<br>district. | Green-<br>ville,<br>Miss. | Ashbrook<br>Neck,<br>Miss. |
| Amount appropriated or allotted since end of last fiscal year (net).....            | \$5,000.00                                                                   | \$420,000.00                         | \$540,000.00                         | \$40,000.00               | \$72,000.00 <sup>1</sup>   |
| Amount expended from beginning of present fiscal year to end of previous month..... | 237.50                                                                       | 150,728.42                           | 201,521.95                           | 40,000.00                 | 64,550.36                  |
| Amount expended during the month.....                                               | 253.98                                                                       | 124,474.20                           | 40,500.73                            |                           | .32                        |
|                                                                                     | -491.48                                                                      | 175,202.62                           | 242,022.68                           | 40,000.00                 | 64,550.68                  |
| Balance unexpended at end of month.....                                             | 4,508.52                                                                     | 244,797.38                           | 297,977.32                           |                           | 7,449.32                   |
| In Treasury United States.....                                                      | 5,000.00                                                                     | 222,693.22                           | 274,389.34                           |                           |                            |
| In hand.....                                                                        | 491.48                                                                       | 22,104.16                            | 23,587.98                            |                           | 7,449.32                   |
|                                                                                     | 4,508.52                                                                     | 244,797.38                           | 297,977.32                           |                           | 7,449.32                   |
| Outstanding liabilities at end of month.....                                        | 2,272.75                                                                     | 65,894.08                            | 85,089.60                            |                           | 3,721.47                   |
| Amount covered by existing contracts at end of month.....                           |                                                                              | 83,178.33                            | 167,028.73                           |                           |                            |
|                                                                                     | 2,272.75                                                                     | 149,072.41                           | 252,118.33                           |                           | 3,721.47                   |
| Balance available at end of month.....                                              | 2,235.77                                                                     | 95,724.97                            | 45,858.99                            |                           | 3,727.85                   |

| Appropriations.                                                                     | Flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                     |                               |                           |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------|-------------------------------|---------------------------|
|                                                                                     | Fittler<br>Bend,<br>Miss.                                                    | Princeton,<br>Miss. | Reid-<br>Bedford<br>Bend, La. | Cotton-<br>wood,<br>Miss. |
| Amount appropriated or allotted since end of last fiscal year (net).....            | \$130,000.00                                                                 | \$120,000.00        | \$52,000.00                   | \$140,000.00              |
| Amount expended from beginning of present fiscal year to end of previous month..... | 121,500.35                                                                   | 75,974.67           | 8,501.87                      | 122,304.59                |
| Amount expended during the month.....                                               | 2,456.69                                                                     | 8,031.67            | 2,493.08                      | 4,396.50                  |
|                                                                                     | 123,957.04                                                                   | 84,006.34           | 10,994.95                     | 126,701.09                |
| Balance unexpended at end of month.....                                             | 6,042.96                                                                     | 35,993.66           | 41,005.05                     | 13,298.91                 |
| In Treasury United States.....                                                      | 3,503.06                                                                     | 42,262.61           | 40,920.06                     | 12,584.29                 |
| In hand.....                                                                        | 2,539.90                                                                     | -6,268.95           | 84.99                         | 714.62                    |
|                                                                                     | 6,042.96                                                                     | 35,993.66           | 41,005.05                     | 13,298.91                 |
| Outstanding liabilities at end of month.....                                        | 4,471.47                                                                     | 11,359.13           | 19,073.54                     | 10,870.47                 |
| Balance available at end of month.....                                              | 1,571.49                                                                     | 24,634.53           | 21,931.51                     | 2,428.44                  |

<sup>1</sup> Amount \$22,995.40, previously reported decreased \$2,573.69, account \$254.09, reimbursement from secretary's office, Mississippi River Commission, for coal; \$376.83, reimbursement from New Orleans, La. District, for operating expenses of plant; and \$1,942.77, reimbursement from Vicksburg, Miss., district, for operating expenses of plant.

<sup>2</sup> Includes \$155 in Treasury settlement No. 32244, for demurrage service; and \$234.35 in Treasury settlement No. 31904; \$1,394.49 in Treasury settlement No. 32429; and \$672.85 in Treasury settlement No. 32413, for freight service.

<sup>3</sup> Includes \$1.24 in Treasury settlement No. 32145, for freight service.

<sup>4</sup> Includes \$440.34 in Treasury settlement No. 31904 for freight service.

<sup>5</sup> Includes \$155 in Treasury settlement No. 32244, for demurrage service; and \$312.04 in Treasury settlement No. 31769; \$234.34 in Treasury settlement No. 31904; \$953.64 in Treasury settlement No. 321833; \$1,394.49 in Treasury settlement No. 32429; and \$672.85 in Treasury settlement No. 32413, for freight service.

## Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.

## THIRD DISTRICT—Continued.

| Appropriations.                                                                     | Flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                                       |                         |                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------|-------------------------|----------------|
|                                                                                     | Grand Lake, Ark.                                                             | Repairs to existing works, and stone. | Plant.                  | Total.         |
| Amount appropriated or allotted since end of last fiscal year (net).....            | \$80,000.00                                                                  | \$50,000.00                           | \$108,000.00            | \$1,757,000.00 |
| Amount expended from beginning of present fiscal year to end of previous month..... | 39,603.78                                                                    | <sup>1</sup> 20,421.71                | <sup>2</sup> 104,856.68 | 950,201.80     |
| Amount expended during the month.....                                               | <sup>3</sup> 6,698.30                                                        | 12,119.70                             | 575.50                  | 102,000.00     |
|                                                                                     | 46,302.08                                                                    | <sup>4</sup> 32,541.41                | 105,432.18              | 1,052,202.40   |
| Balance unexpended at end of month.....                                             | 33,697.92                                                                    | 17,458.59                             | 2,567.82                | 704,797.40     |
| In Treasury United States.....                                                      | 33,551.08                                                                    | 23,145.01                             | 2,959.48                | 661,008.30     |
| In hand.....                                                                        | 146.84                                                                       | —5,686.42                             | —391.66                 | 43,789.30      |
|                                                                                     | 33,697.92                                                                    | 17,458.59                             | 2,567.82                | 704,797.40     |
| Outstanding liabilities at end of month.....                                        | 21,593.72                                                                    | 13,058.47                             | 2,567.82                | 239,972.30     |
| Amount covered by existing contracts at end of month.....                           |                                                                              |                                       |                         | 250,207.00     |
|                                                                                     | 21,593.72                                                                    | 13,058.47                             | 2,567.82                | 490,179.30     |
| Balance available at end of month.....                                              | 12,104.20                                                                    | 4,400.12                              | .....                   | 214,617.80     |

<sup>1</sup> Amount, \$22,995.40, previously reported decreased \$2,573.69, account \$254.09, reimbursement from secretary's office, Mississippi River Commission, for coal; \$376.83, reimbursement from New Orleans La. district, for operating expenses of plant; and \$1,942.77, reimbursement from Vicksburg, Miss., district, for operating expenses of plant.

<sup>2</sup> Amount, \$105,194.37, previously reported decreased \$337.69, account reimbursement from fourth Mississippi River Commission district, for repairs to tug Tunica.

<sup>3</sup> Includes \$440.34 in Treasury settlement No. 31904, for freight service.

<sup>4</sup> Distributed as follows: Panther Forest, Ark., \$8,280.13; Red Fork, Ark., \$25.67; Greenville, Miss., \$1,327.06; Vicksburg, Miss., \$4,283.40; and stone, third district, \$18,525.15.

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

## THIRD DISTRICT—Continued.

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for— |                             |                                       |                           |              |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------|---------------------------|--------------|
|                                                                                     | Upper Tensas levee district.                                                                        | Lower Yazoo levee district. | Repairs to existing works, and stone. | Expended allotments.      | Total.       |
| Amount expended on present project to end of last fiscal year.....                  | \$219,981.70                                                                                        | \$260,552.38                | (1)                                   | <sup>2</sup> \$312,015.40 | \$792,549.48 |
| Balance unexpended at end of last fiscal year.....                                  | 180,018.45                                                                                          | 111,447.62                  |                                       |                           | 291,466.07   |
| Amount expended from beginning of present fiscal year to end of previous month..... | 37,549.42                                                                                           | 36,092.46                   |                                       |                           | 73,641.88    |
| Amount expended during the month.....                                               | 6,010.85                                                                                            |                             |                                       |                           | 6,010.85     |
|                                                                                     | 43,560.27                                                                                           | 36,092.46                   |                                       |                           | 79,652.73    |
| Balance unexpended at end of month.....                                             | 136,458.18                                                                                          | 75,355.16                   |                                       |                           | 211,813.34   |
| On Treasury United States.....                                                      | 135,000.00                                                                                          | 64,964.31                   |                                       |                           | 199,964.31   |
| On hand.....                                                                        | 1,458.18                                                                                            | 10,390.85                   |                                       |                           | 11,849.03    |
|                                                                                     | 136,458.18                                                                                          | 75,355.16                   |                                       |                           | 211,813.34   |
| Amount covered by existing contracts at end of month.....                           | 136,458.18                                                                                          | 75,355.16                   |                                       |                           | 211,813.34   |

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works,<br>act of Mar. 4, 1915, allotment for— |                                       |                                      |                            |                         |                |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------|----------------------------|-------------------------|----------------|
|                                                                                     | Surveys,<br>third<br>district.                                                                         | Upper<br>Tensas<br>levee<br>district. | Lower<br>Yazoo<br>levee<br>district. | Ashbrook<br>Neck,<br>Miss. | Expended<br>allotments. | Total.         |
| Amount expended on present project to end of last fiscal year.....                  | \$7,451.08                                                                                             | \$166,798.41                          | \$183,680.49                         | \$48,225.17                | \$724,390.79            | \$1,130,545.94 |
| Balance unexpended at end of last fiscal year.....                                  | 2,548.92                                                                                               | 34,501.59                             | 7,620.51                             | 26,774.83                  | .....                   | 71,445.85      |
| Amount expended from beginning of present fiscal year to end of previous month..... | 2,548.92                                                                                               | 34,501.59                             | 7,620.51                             | 26,774.83                  | .....                   | 71,445.85      |

<sup>1</sup> Total expenditures (\$55,232.60) under this allotment to end of fiscal year 1917, have been distributed as follows: Lake Bolivar Front, \$2,503.18; Panther Forest, Ark., \$30,529.03; Greenville, Miss., \$1,664.60; Fifters Bend, \$7,990.74; Delta Point, La., \$1,062.27; Albemarle Bend, \$1.88; stone, \$6,808.68; Vauluse, Ark., \$4,672.22.

<sup>2</sup> Greenville, Miss., \$81,664.60; surveys, third district, \$2,000; Fifters Bend, \$12,079.21; Delta Point, La., \$1,431.17; Reid-Badford Bend, \$705.71; Ashbrook Neck, \$643.07; Panther Forest, Ark., \$44,624.50; Albemarle Bend, \$4,105.47; Lake Bolivar Front, \$7,438.43; Vauluse, Ark., \$7,699.37; stone, third district, \$19,623.87; Grand Lake, Ark., \$80,000; plant, third district, \$50,000.

<sup>3</sup> Greenville, Miss., \$110,969.50; Fifters Bend, \$75,740.55; Panther Forest, Ark., \$120,006.50; Lake Bolivar Front, \$79,000; Vauluse, Ark., \$6,795.50; stone, third district, \$1,538.03; Grand Lake, Ark., \$60,038.20; plant, third district, \$182,378.41; Ashbrook dike, \$88,924.10; experimental revetment, \$8,000.

## Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.

## THIRD DISTRICT—Continued.

| Appropriations.                                                                   | Funds contributed for flood control, Mississippi River (special fund). |                                    |                              |                                  |                                  |                   |            |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------|------------------------------|----------------------------------|----------------------------------|-------------------|------------|
|                                                                                   | Upper Tensas levee district.                                           |                                    |                              | Lower Yazoo levee district.      | Greenville, Miss.                |                   | Total.     |
|                                                                                   | Fifth Louisiana levee district.                                        | Southeast Arkansas levee district. | Tensas Basin levee district. | Mississippi levee Commissioners. | Mississippi levee Commissioners. | Greenville, Miss. |            |
| Amount appropriated or allotted since end of last fiscal year (net) .....         | \$71,334.00                                                            | \$46,666.67                        | \$92,000.00                  | \$270,001.00                     | \$22,500.00                      | \$13,000.00       | \$515,501. |
| Amount expended from beginning of present fiscal year to end of previous month .. | 57,907.60                                                              | .....                              | 4,500.00                     | 108,809.37                       | 22,500.00                        | 13,000.00         | 206,716.   |
| Amount expended during the month .....                                            | 1,595.65                                                               | .....                              | 6,370.50                     | 19,716.69                        | .....                            | .....             | 27,682.    |
|                                                                                   | 59,503.25                                                              | .....                              | 10,870.50                    | 128,526.06                       | 22,500.00                        | 13,000.00         | 234,399.   |
| Balance unexpended at end of month .....                                          | 11,830.75                                                              | 46,666.67                          | 81,129.50                    | 141,474.94                       | .....                            | .....             | 281,101.   |
| In Treasury United States .....                                                   | 10,000.00                                                              | <sup>2</sup> 41,666.67             | <sup>3</sup> 74,000.00       | <sup>4</sup> 130,001.00          | .....                            | .....             | 255,667.   |
| In hand .....                                                                     | 1,830.75                                                               | 5,000.00                           | 7,129.50                     | 11,473.94                        | .....                            | .....             | 25,434.    |
|                                                                                   | 11,830.75                                                              | 46,666.67                          | 81,129.50                    | 141,474.94                       | .....                            | .....             | 281,101.   |
| Outstanding liabilities at end of month .....                                     | 11,830.75                                                              | .....                              | 30,824.50                    | 30,824.50                        | .....                            | .....             | 73,479.    |
| Amount covered by existing contracts at end of month ..                           | .....                                                                  | 46,666.67                          | .....                        | 87,719.94                        | .....                            | .....             | 134,386.   |
|                                                                                   | 11,830.75                                                              | 46,666.67                          | 30,824.50                    | 118,544.44                       | .....                            | .....             | 207,866.   |
| Balance available at end of month .....                                           | .....                                                                  | .....                              | 50,305.00                    | 22,930.50                        | .....                            | .....             | 73,235.    |

<sup>1</sup> \$10,000.00 Not yet in Treasury of United States. Deposited in local banks, covered by bonds, and<sup>2</sup> \$41,666.67 subject to check of President, Mississippi River Commission.<sup>3</sup> \$48,000.00 Of this amount not yet in Treasury United States. Deposited in local banks, covered by<sup>4</sup> \$70,000.00 bonds, and subject to check of President, Mississippi River Commission.

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

## THIRD DISTRICT—Continued.

| Appropriations.                                                                        | Expended<br>appropria-<br>tions. | Increase of<br>compensa-<br>tion, rivers<br>and harbors,<br>1918. | Grand total.    |
|----------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------|-----------------|
| Amount expended on present project to end of last fiscal year..                        | <sup>1</sup> \$811,604.43        |                                                                   | \$29,220,116.29 |
| Balance unexpended at end of last fiscal year.....                                     |                                  |                                                                   | 1,201,971.27    |
| Amount appropriated or allotted since (net).....                                       |                                  | \$5,000.00                                                        | 2,287,076.64    |
|                                                                                        |                                  | 5,000.00                                                          | 3,489,047.91    |
| Amount expended from beginning of present fiscal year to end<br>of previous month..... |                                  | 4,151.97                                                          | 1,934,572.83    |
| Amount expended during the month.....                                                  |                                  | 440.66                                                            | 178,715.71      |
|                                                                                        |                                  | 4,592.63                                                          | 2,113,288.54    |
| Balance unexpended at end of month.....                                                |                                  | 407.37                                                            | 1,375,759.37    |
| In Treasury United States.....                                                         |                                  |                                                                   | 1,262,896.76    |
| In hand.....                                                                           |                                  | 407.37                                                            | 112,862.61      |
|                                                                                        |                                  | 407.37                                                            | 1,375,759.37    |
| Outstanding liabilities at end of month.....                                           |                                  | 493.38                                                            | 340,307.52      |
| Amount covered by existing contracts at end of month.....                              |                                  |                                                                   | 724,948.69      |
|                                                                                        |                                  | 493.38                                                            | 1,065,256.21    |
| Balance available at end of month.....                                                 |                                  | <sup>2</sup> —86.01                                               | 310,503.16      |

<sup>1</sup> Maintaining and protecting levees of the Mississippi River and tributaries against floods (protection of levees, third district, \$170,618.52; protection of levees, Red River and tributaries, \$5,729.35); \$176,347.87; examinations, surveys, and contingencies of rivers and harbors (canal leading from Centennial Lake at Vicksburg, Miss., to the Mississippi River), \$2,000; rebuilding levees of the Mississippi River and tributaries damaged by floods (lower Yazoo levee district, \$210,000; upper Tensas levee district, \$415,000; Red River levees, \$8,256.56), \$633,256.56.

<sup>2</sup> Estimate for \$86.01 to be submitted.

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## FOURTH DISTRICT.

[Appropriations: Mississippi River; flood control, Mississippi River and Sacramento River, Cal.: fund contributed for flood control, Mississippi River; maintenance and improvement of existing river and harbor works; increase of compensation, rivers and harbors, 1918; emergencies in river and harbor works maintaining and protecting levees of Mississippi River and tributaries against floods; removing sunken vessels or craft obstructing or endangering navigation; rebuilding levees of the Mississippi River and tributaries damaged by floods; funds contributed for improvement of Mississippi River.]

|                                                                                     | Appropriation for Mississippi River, allotment for— |                              |                             |                           |                           |                            |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------|-----------------------------|---------------------------|---------------------------|----------------------------|
|                                                                                     | Surveys, gauges, and observations.                  | Lower Tensas levee district. | Atchafalaya levee district. | Lafourche levee district. | Barataria levee district. | Homochitto levee district. |
| Amount expended on present project to end of last fiscal year.....                  | \$150,680.79                                        | \$4,776,620.92               | \$2,051,877.22              | \$900,913.67              | \$702,020.40              | \$2,508.8                  |
| Balance unexpended at end of last fiscal year.....                                  | 4,490.83                                            | 285,587.26                   | 142,259.95                  | 79,855.47                 | 68,143.55                 | 493.7                      |
| Amount expended from beginning of present fiscal year to end of previous month..... | 4,440.99                                            | 135,040.67                   | 69,223.83                   | 73,778.08                 | 16,219.58                 | 69.7                       |
| Amount expended during the month.....                                               |                                                     | 6,356.23                     | 8,587.24                    |                           | 2,230.75                  |                            |
|                                                                                     | 4,440.99                                            | 141,396.90                   | 77,811.07                   | 73,778.08                 | 18,450.33                 | 69.7                       |
| Balance unexpended at end of month.....                                             | 49.84                                               | 144,190.36                   | 64,448.88                   | 6,077.39                  | 49,693.22                 | 424.0                      |
| In Treasury United States.....                                                      |                                                     | 137,956.53                   | 61,830.19                   |                           | 28,009.63                 | 2.3                        |
| In hand.....                                                                        | 49.84                                               | 6,233.83                     | 2,618.69                    | 6,077.39                  | 21,683.59                 | 421.6                      |
|                                                                                     | 49.84                                               | 144,190.36                   | 64,448.88                   | 6,077.39                  | 49,693.22                 | 424.0                      |
| Outstanding liabilities at end of month.....                                        | 49.84                                               |                              | 7,523.81                    | 6,077.39                  | 49,693.22                 |                            |
| Amount covered by existing contracts at end of month.....                           |                                                     | 144,190.36                   | 56,925.07                   |                           |                           |                            |
|                                                                                     | 49.84                                               | 144,190.36                   | 64,448.88                   | 6,077.39                  | 49,693.22                 |                            |
| Balance available at end of month.....                                              |                                                     |                              |                             |                           |                           | 424.0                      |

Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

|                                                                                           | Appropriation for Mississippi River, allotment for— |                                      |                        |                 |                                  |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------|------------------------|-----------------|----------------------------------|
|                                                                                           | Pontchar-<br>train<br>levee<br>district.            | Lake<br>Borgne<br>levee<br>district. | Hard<br>Times<br>Bend. | Bondu-<br>rant. | Kempe<br>Bend<br>revet-<br>ment. |
| Amount expended on present project to<br>end of last fiscal year.....                     | \$2,092,338.41                                      | \$622,537.25                         | \$174,277.49           | \$90,359.84     | \$1,330,160.42                   |
| Balance unexpended at end of last fiscal<br>year.....                                     | 95,255.89                                           | 37,023.86                            | 70,722.51              | 23,140.16       | 29,839.58                        |
| Amount appropriated or allotted since<br>(net).....                                       | <sup>1</sup> 1,740.84                               |                                      |                        |                 |                                  |
|                                                                                           | 96,996.73                                           | 37,023.86                            | 70,722.51              | 23,140.16       | 29,839.58                        |
| Amount expended from beginning of<br>present fiscal year to end of previous<br>month..... | 95,817.64                                           | 18,687.20                            | 8,339.25               | 22,864.82       | <sup>2</sup> 26,729.88           |
| Amount expended during the month....                                                      | .35                                                 | 18.71                                |                        |                 | 86.05                            |
|                                                                                           | 95,817.99                                           | 18,705.91                            | 8,339.25               | 22,864.82       | 26,815.93                        |
| Balance unexpended at end of<br>month.....                                                | 1,178.74                                            | 18,317.95                            | 62,383.26              | 275.34          | 3,023.65                         |
| From Treasury United States.....                                                          | 1,238.34                                            | 4,007.50                             | 48,044.44              |                 | 3,023.65                         |
| On hand.....                                                                              | —59.60                                              | 14,310.45                            | 14,338.82              | 275.34          |                                  |
|                                                                                           | 1,178.74                                            | 18,317.95                            | 62,383.26              | 275.34          | 3,023.65                         |
| Outstanding liabilities at end of month..                                                 |                                                     | 134.18                               |                        | 275.34          |                                  |
| Amount covered by existing contracts at<br>end of month.....                              | 1,178.74                                            |                                      |                        |                 |                                  |
|                                                                                           |                                                     | 18,183.77                            | 62,383.26              |                 | 3,023.65                         |
| Balance available at end of month....                                                     |                                                     |                                      |                        |                 |                                  |

<sup>1</sup> Amount, \$1,406.87, previously reported increased \$333.97, received from rental of levee machine barge, (ED 93650-24).

<sup>2</sup> Amount, \$29,753.53, previously reported decreased \$3,023.65 by reimbursement from third Mississippi River Commission district for rock.

## Consolidated statement of condition of appropriations and allotments and Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

|                                                                                     | Appropriation for Mississippi River, allotment for— |               |              |                            |                      |
|-------------------------------------------------------------------------------------|-----------------------------------------------------|---------------|--------------|----------------------------|----------------------|
|                                                                                     | Giles Bend.                                         | Marengo Bend. | Grand Bay.   | General repairs and stone. | Plant.               |
| Amount expended on present project to end of last fiscal year.....                  | \$38,789.80                                         | \$54,788.89   | \$142,565.51 | <sup>1</sup> \$54,186.94   | \$1,330,846.         |
| Balance unexpended at end of last fiscal year.....                                  | 71,210.20                                           | 35,211.11     | 32,434.49    | 13,813.06                  | 28,676.              |
| Amount appropriated or allotted since (net).....                                    |                                                     |               |              |                            | <sup>2</sup> 4,706.  |
|                                                                                     | 71,210.20                                           | 35,211.11     | 32,434.49    | 13,813.06                  | 33,383.              |
| Amount expended from beginning of present fiscal year to end of previous month..... | 22,744.95                                           | 35,211.11     | 32,434.49    | 13,813.06                  | <sup>3</sup> 13,546. |
| Amount expended during the month....                                                | 6,836.79                                            |               |              |                            |                      |
|                                                                                     | 29,581.74                                           | 35,211.11     | 32,434.49    | <sup>4</sup> 13,813.06     | 13,546.              |
| Balance unexpended at end of month.....                                             | 41,628.46                                           |               |              |                            | 19,837.              |
| In Treasury United States.....                                                      | 35,002.93                                           |               |              |                            | 21,940.              |
| In hand.....                                                                        | 6,625.53                                            |               |              |                            | -2,103.              |
|                                                                                     | 41,628.46                                           |               |              |                            | 19,837.              |
| Outstanding liabilities at end of month..                                           | 12,635.69                                           |               |              |                            | 4,173.               |
| Balance available at end of month..                                                 | 28,992.77                                           |               |              |                            | 15,663.              |

<sup>1</sup> Amount, \$9,186.94, expended during the fiscal year 1917, distributed to following works: Harbor at New Orleans, La., \$3,186.94; Plaquemine, La., revetment, \$6,000.

<sup>2</sup> Amount, \$4,656.72, previously reported in reased \$50.20 account \$37.90 received for wear and tear of plant in building barge for "Panama Canal" (ED 91263-376), and \$12.30 for wear and tear of plant in building barge for "First New Orleans, La., Engineer District" (ED 96661-32).

<sup>3</sup> Amount, \$14,048.85, previously reported decreased \$502.09 account reimbursement \$379.09 from "Panama Canal" for building barge (ED 91263-76), and \$123 from "First New Orleans, La., Engineer District" for building barge (ED 96661-32).

<sup>4</sup> Distributed as follows: Bondurant, \$3,666.20; Kempe Bend revetment, \$71.43; Grand Bay, \$139.00; Plaquemine, La., revetment, \$7,666.36; harbor at New Orleans, La., \$639.77; Atchafalaya and Red River, La., \$1,629.75.

Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

|                                                                                           | Appropriation for Mississippi River, allotment for— |                                          |                                         |                                          |                 |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------|-----------------------------------------|------------------------------------------|-----------------|
|                                                                                           | Harbor<br>at New<br>Orleans,<br>La.                 | Atchafalaya<br>and<br>Red Rivers,<br>La. | Expended<br>general<br>allot-<br>ments. | Expended<br>specific<br>allot-<br>ments. | Total.          |
| Amount expended on present pro-<br>ject to end of last fiscal year.....                   | \$1,052,335.80                                      | \$150,397.61                             | <sup>1</sup> \$1,938,418.42             | <sup>2</sup> \$2,268,066.65              | \$19,924,691.82 |
| Balance unexpended at end of last<br>fiscal year.....                                     | 111,932.48                                          | 56.34                                    |                                         |                                          | 1,130,147.37    |
| Amount appropriated or allotted<br>since (net).....                                       |                                                     |                                          |                                         |                                          | 6,447.76        |
|                                                                                           | 111,932.48                                          | 56.34                                    |                                         |                                          | 1,136,595.13    |
| Amount expended from beginning<br>of present fiscal year to end of<br>previous month..... | <sup>3</sup> 82,373.32                              | 15.18                                    |                                         |                                          | 671,350.52      |
| Amount expended during the month                                                          | 15,705.56                                           |                                          |                                         |                                          | 39,821.68       |
|                                                                                           | 98,078.88                                           | 15.18                                    |                                         |                                          | 711,172.20      |
| Balance unexpended at end<br>of month.....                                                | <sup>4</sup> 13,853.60                              | 41.16                                    |                                         |                                          | 425,422.93      |
| On Treasury United States.....                                                            | 13,920.08                                           |                                          |                                         |                                          | 354,976.12      |
| On hand.....                                                                              | —66.48                                              | 41.16                                    |                                         |                                          | 70,446.81       |
|                                                                                           | 13,853.60                                           | 41.16                                    |                                         |                                          | 425,422.93      |
| Outstanding liabilities at end of<br>month.....                                           | 17,023.11                                           | 41.16                                    |                                         |                                          | 97,626.90       |
| Amount covered by existing con-<br>tracts at end of month.....                            |                                                     |                                          |                                         |                                          | 202,294.17      |
|                                                                                           | 17,023.11                                           | 41.16                                    |                                         |                                          | 299,921.07      |
| Balance available at end of<br>month.....                                                 | <sup>4</sup> —3,169.51                              |                                          |                                         |                                          | 125,501.86      |

<sup>1</sup> Preservation of works, \$134,000; Plaquemine, La., revetment, \$150,000; Reid-Bedford Bend, \$17,404.63; dredges and dredging, \$2,506.99; Natchez and Vidalia Harbors, Miss. and La., \$1,564,506.80.

<sup>2</sup> Improving harbors at Natchez and Vidalia, Miss. and La., \$282,252.04; improving harbor at New Orleans, La., \$979,639.86; improving Atchafalaya and Red Rivers, La., \$1,001,709.40; survey east bank of Mississippi River from Warrenton to Baton Rouge, \$4,465.35.

<sup>3</sup> Amount, \$95,808.10, previously reported decreased \$13,434.78 account reimbursement from Board of Commissioners, Port of New Orleans, for constructing and sinking mattresses. (ED 74811-61).

<sup>4</sup> Does not include \$30,069.43 reimbursable from other districts.

Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

|                                                                                             | Flood control, Mississippi River, and Sacramento River<br>Cal., allotment for— |                                       |                                     |                                 |                                 |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------|-------------------------------------|---------------------------------|---------------------------------|
|                                                                                             | Surveys.                                                                       | Lower<br>Tensas<br>levee<br>district. | Atchafa-<br>laya levee<br>district. | Lafourche<br>levee<br>district. | Barataria<br>levee<br>district. |
| Amount appropriated or allotted since (net) . . .                                           | \$5,010.25                                                                     | \$315,002.00                          | \$130,000.00                        | \$85,000.00                     | \$80,001.                       |
| Amount expended from beginning of present<br>fiscal year to end of previous month . . . . . | 2,947.11                                                                       | 38,821.49                             | 27,762.32                           | 50,157.44                       | 36,611.                         |
| Amount expended during the month . . . . .                                                  | 899.13                                                                         | 657.50                                | 9,192.87                            | 16,067.70                       | 1,984.                          |
|                                                                                             | 3,846.24                                                                       | 39,478.99                             | 36,955.19                           | 66,225.14                       | 38,596.                         |
| Balance unexpended at end of month . . . . .                                                | 1,164.01                                                                       | 275,523.01                            | 93,044.81                           | 18,774.86                       | 41,404.                         |
| In Treasury United States . . . . .                                                         | 10.25                                                                          | 270,566.40                            | 90,559.04                           | 15,032.09                       | 28,490.                         |
| In hand . . . . .                                                                           | 1,153.76                                                                       | 4,956.61                              | 2,485.77                            | 3,742.77                        | 12,914.                         |
|                                                                                             | 1,164.01                                                                       | 275,523.01                            | 93,044.81                           | 18,774.86                       | 41,404.                         |
| Outstanding liabilities at end of month . . . . .                                           | 807.79                                                                         |                                       | 40,067.98                           |                                 | 9,662.                          |
| Amount covered by existing contracts at end<br>of month . . . . .                           |                                                                                | 275,523.01                            | 52,976.83                           | 18,774.86                       | 31,742.                         |
|                                                                                             | 807.79                                                                         | 275,523.01                            | 93,044.81                           | 18,774.86                       | 41,404.                         |
| Balance available at end of month . . . . .                                                 | 356.22                                                                         |                                       |                                     |                                 |                                 |

|                                                                                             | Flood control, Mississippi River, and Sacramento River<br>Cal., allotment for— |                                      |                        |                  |                                  |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------|------------------------|------------------|----------------------------------|
|                                                                                             | Pontchar-<br>train<br>levee<br>district.                                       | Lake<br>Borgne<br>levee<br>district. | Hard<br>Times<br>Bend. | Bondur-<br>rant. | Kempe<br>Bend<br>revet-<br>ment. |
| Amount appropriated or allotted since (net) . . .                                           | \$80,002.00                                                                    | \$50,000.00                          | \$25,000.00            | \$25,000.00      | \$100,000.00                     |
| Amount expended from beginning of present<br>fiscal year to end of previous month . . . . . | 49,845.01                                                                      | 12,099.10                            | 131.94                 | 18,672.34        | 100,000.00                       |
| Amount expended during the month . . . . .                                                  | 6,853.16                                                                       | 5,981.15                             |                        | 122.00           |                                  |
|                                                                                             | 56,698.17                                                                      | 18,080.25                            | 131.94                 | 18,794.34        | 100,000.00                       |
| Balance unexpended at end of month . . . . .                                                | 23,303.83                                                                      | 31,919.75                            | 24,868.06              | 6,205.66         |                                  |
| In Treasury United States . . . . .                                                         | 22,035.13                                                                      | 17,975.90                            | 24,868.06              |                  |                                  |
| In hand . . . . .                                                                           | 1,268.70                                                                       | 13,943.85                            |                        | 6,205.66         |                                  |
|                                                                                             | 23,303.83                                                                      | 31,919.75                            | 24,868.06              | 6,205.66         |                                  |
| Outstanding liabilities at end of month . . . . .                                           |                                                                                |                                      |                        | 169.32           |                                  |
| Amount covered by existing contracts at end<br>of month . . . . .                           | 23,303.83                                                                      | 25,989.70                            |                        |                  |                                  |
| Balance available at end of month . . . . .                                                 |                                                                                | 5,930.05                             | 24,868.06              | 6,036.34         |                                  |

*Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.*

## FOURTH DISTRICT—Continued.

|                                                                                     | Flood control, Mississippi, River and Sacramento River, Cal., allotment for— |               |                |              |                              |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------|----------------|--------------|------------------------------|
|                                                                                     | Giles Bend.                                                                  | Marengo Bend. | Nat hez Front. | Grand Bay.   | Plaque-mine, La., revetment. |
| Amount appropriated or allotted since (net)....                                     | \$35,000.00                                                                  | \$30,000.00   | \$10,000.00    | \$150,000.00 | \$75,000.00                  |
| Amount expended from beginning of present fiscal year to end of previous month..... | 10,839.95                                                                    | 10,507.84     | 2,833.37       | 31,001.02    | 75,000.00                    |
| Amount expended during the month.....                                               | 11,098.07                                                                    |               |                | 1,433.05     |                              |
|                                                                                     | 21,938.02                                                                    | 10,507.84     | 2,833.37       | 32,434.07    | 75,000.00                    |
| Balance unexpended at end of month....                                              | 13,061.98                                                                    | 19,492.16     | 7,166.63       | 117,565.93   |                              |
| In Treasury United States.....                                                      | 15,538.54                                                                    | 14,694.66     | 4,166.63       | 116,552.48   |                              |
| In hand.....                                                                        | -2,476.56                                                                    | 4,797.50      | 3,000.00       | 1,013.45     |                              |
|                                                                                     | 13,061.98                                                                    | 19,492.16     | 7,166.63       | 117,565.93   |                              |
| Outstanding liabilities at end of month.....                                        |                                                                              | 134.96        | 287.60         | 137.10       |                              |
| Balance available at end of month.....                                              | 13,061.98                                                                    | 19,357.20     | 6,879.03       | 117,428.83   |                              |

| Appropriations.                                                                     | Flood control, Mississippi River, and Sacramento River, Cal., allotment for— |                        |                            |                                 |                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------|----------------------------|---------------------------------|----------------|
|                                                                                     | General repairs, and stone.                                                  | Plant.                 | Harbor at New Orleans, La. | Atchafalaya and Red Rivers, La. | Total.         |
| Amount appropriated or allotted since (net).....                                    | \$34,000.00                                                                  | \$80,241.88            | \$150,000.00               | \$15,002.00                     | \$1,474,259.38 |
| Amount expended from beginning of present fiscal year to end of previous month..... | 30,792.90                                                                    | <sup>2</sup> 47,027.09 | <sup>3</sup> 12,297.07     | 10,907.35                       | 568,255.04     |
| Amount expended during the month.....                                               | 15.40                                                                        | 9,960.97               | 7,889.70                   | 591.93                          | 72,747.19      |
|                                                                                     | <sup>4</sup> 30,808.30                                                       | 56,988.06              | 20,186.77                  | 11,499.28                       | 641,002.23     |
| Balance unexpended at end of month.....                                             | 3,191.70                                                                     | <sup>5</sup> 23,253.82 | <sup>6</sup> 129,813.23    | 3,502.72                        | 833,257.15     |
| In Treasury United States.....                                                      |                                                                              | 38,138.76              | 125,305.40                 | 2.00                            | 783,935.48     |
| In hand.....                                                                        | 3,191.70                                                                     | -14,884.94             | 4,507.83                   | 3,500.72                        | 49,321.67      |
|                                                                                     | 3,191.70                                                                     | 23,253.82              | 129,813.23                 | 3,502.72                        | 833,257.15     |
| Outstanding liabilities at end of month.....                                        | 46.75                                                                        | 7,752.57               | 17,033.00                  | 621.11                          | 76,720.94      |
| Amount covered by existing contracts at end of month.....                           |                                                                              |                        |                            |                                 | 428,310.46     |
|                                                                                     | 46.75                                                                        | 7,752.57               | 17,033.00                  | 621.11                          | 505,031.40     |
| Balance available at end of month.....                                              | 3,144.95                                                                     | <sup>5</sup> 15,501.25 | <sup>6</sup> 112,780.23    | 2,881.61                        | 328,225.75     |

<sup>1</sup> Amount, \$75,885.08, previously reported increased \$4,356.80, for wear and tear of plant constructing barges, etc., \$3,851.55, from "First New Orleans, La., engineer district" (ED 99661-32-33-34), and \$505.25 from "Panama Canal" (ED 91263-376).

<sup>2</sup> Amount, \$90,595.03, previously reported decreased \$43,567.94, account reimbursement for constructing barges, etc., \$38,515.49, from "First New Orleans, La., engineer district (ED 99661-32-33-34), and \$5,052.45 from "Panama Canal" (ED 91263-376).

<sup>3</sup> Amount, \$25,579.74 previously reported decreased \$13,282.67, account reimbursement from Board of Commissioners of the Port of New Orleans, La., for constructing and sinking mattresses in front of docks, etc.

<sup>4</sup> Distributed as follows: Bondurant, \$12,253.93; Kempe Bend revetment, \$1,777.83; Grand Bay, \$917.10; Plaquemine, La., revetment, \$14,343.25; Atchafalaya and Red Rivers, La., \$1,516.19.

<sup>5</sup> Does not include \$6,366.39 } Reimbursable from other districts.

<sup>6</sup> Does not include \$10,192.61 }

## Consolidated statement of condition of appropriations and allotments under Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914, allotment for— |                |                      |              |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------|----------------------|--------------|
|                                                                                     | Lower Tensas levee district.                                                                        | Natchez Front. | Expended allotments. | Total.       |
| Amount expended on present project to end of last fiscal year.....                  | \$254,016.42                                                                                        | \$11,807.18    | \$786,778.61         | \$1,052,602. |
| Balance unexpended at end of last fiscal year.....                                  | 20,983.58                                                                                           | 192.82         | .....                | 21,176.      |
| Amount expended from beginning of present fiscal year to end of previous month..... | .....                                                                                               | 192.82         | .....                | 192.         |
| Amount expended during the month.....                                               | 611.66                                                                                              | .....          | .....                | 611.         |
|                                                                                     | 611.66                                                                                              | 192.82         | .....                | 804.         |
| Balance unexpended at end of month.....                                             | 20,371.92                                                                                           | .....          | .....                | 20,371.      |
| In hand.....                                                                        | 20,371.92                                                                                           | .....          | .....                | 20,371.      |
|                                                                                     | 20,371.92                                                                                           | .....          | .....                | 20,371.      |
| Amount covered by existing contracts at end of month.....                           | 20,371.92                                                                                           | .....          | .....                | 20,371.      |

| Appropriations.                                                                     | Maintenance and improvement of existing river and harbor works act of Mar. 4, 1915, allotment for— |                              |                             |                               |                  |                       |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|-------------------------------|------------------|-----------------------|
|                                                                                     | Surveys.                                                                                           | Lower Tensas levee district. | Atchafalaya levee district. | Pontchartrain levee district. | Hard Times Bend. | Kempe Bend revetment. |
| Amount expended on present project to end of last fiscal year.....                  | \$4,691.32                                                                                         | \$137,564.64                 | \$49,468.40                 | \$39,250.58                   | \$120,999.99     | \$19,998.             |
| Balance unexpended at end of last fiscal year.....                                  | 122.84                                                                                             | 112,242.36                   | 34,487.12                   | 866.92                        | .....            | 1.                    |
| Amount expended from beginning of present fiscal year to end of previous month..... | 122.84                                                                                             | 27,905.27                    | 21,448.29                   | 866.92                        | .....            | 1.                    |
| Amount expended during the month.....                                               | .....                                                                                              | .....                        | 1,667.22                    | .....                         | .....            | .....                 |
|                                                                                     | 122.84                                                                                             | 27,905.27                    | 23,115.51                   | 866.92                        | .....            | 1.                    |
| Balance unexpended at end of month.....                                             | .....                                                                                              | 84,337.09                    | 11,371.61                   | .....                         | .....            | .....                 |
| In Treasury United States.....                                                      | .....                                                                                              | 66,160.06                    | 8,955.52                    | .....                         | .....            | .....                 |
| In hand.....                                                                        | .....                                                                                              | 18,177.03                    | 2,416.09                    | .....                         | .....            | .....                 |
|                                                                                     | .....                                                                                              | 84,337.09                    | 11,371.61                   | .....                         | .....            | .....                 |
| Amount covered by existing contracts at end of month.....                           | .....                                                                                              | 84,337.09                    | 11,371.61                   | .....                         | .....            | .....                 |

<sup>1</sup> Lafourche levee district, \$100,000; Barataria levee district, \$76,265; Lake Borgne levee district, \$75,000; Giles Bend, \$40,184.25; Plaquemine, La., \$50,000; plant, \$60,513.61; Harbor at New Orleans, La., \$54,529.13; Atchafalaya and Red Rivers, La., \$15,000; Hard Times Bend, \$22,714.44; Bonduran, \$2,319.22; Atchafalaya levee district, \$125,000; Pontchartrain levee district, \$100,000; Kempe Bend revetment, \$60,252.96; Marengo Bend, \$5,000.

*Consolidated statement of condition of appropriations and allotments under  
Mississippi River Commission on June 30, 1918—Continued.*

## FOURTH DISTRICT—Continued.

| Appropriations.                                                                             | Maintenance and improvement of existing river and harbor works<br>act of Mar. 4, 1915, allotment for— |                                      |                                     |                                            |                         |              |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------------|-------------------------|--------------|
|                                                                                             | Plaque-<br>mine, La.,<br>revet-<br>ment.                                                              | General<br>repairs,<br>and<br>stone. | Harbor<br>at New<br>Orleans,<br>La. | Atchafa-<br>laya and<br>Red<br>Rivers, La. | Expended<br>allotments. | Total.       |
| Amount expended on present pro-<br>ject to end of last fiscal year.....                     | \$28,385.18                                                                                           | (1)                                  | \$37,675.91                         | \$19,832.85                                | \$441,729.95            | \$899,597.25 |
| Balance unexpended at end of<br>last fiscal year.....                                       |                                                                                                       |                                      |                                     |                                            |                         | 147,720.81   |
| Amount expended from beginning<br>of present fiscal year to end of pre-<br>vious month..... |                                                                                                       |                                      |                                     |                                            |                         | 50,344.89    |
| Amount expended during the month.....                                                       |                                                                                                       |                                      |                                     |                                            |                         | 1,667.22     |
|                                                                                             |                                                                                                       |                                      |                                     |                                            |                         | 52,012.11    |
| Balance unexpended at end of<br>month.....                                                  |                                                                                                       |                                      |                                     |                                            |                         | 95,708.70    |
| From Treasury United States.....                                                            |                                                                                                       |                                      |                                     |                                            |                         | 75,115.58    |
| From hand.....                                                                              |                                                                                                       |                                      |                                     |                                            |                         | 20,593.12    |
|                                                                                             |                                                                                                       |                                      |                                     |                                            |                         | 95,708.70    |
| Amount covered by existing con-<br>tracts at end of month.....                              |                                                                                                       |                                      |                                     |                                            |                         | 95,708.70    |

| Appropriations.                                            | Funds contributed for control, Mississippi River (special fund). |                                                 |                                          |                                          |                                               |                             |              |
|------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------|------------------------------------------|------------------------------------------|-----------------------------------------------|-----------------------------|--------------|
|                                                            | Fifth<br>Louisiana<br>levee<br>district.                         | Atchafa-<br>laya<br>Basin<br>levee<br>district. | Lafourche<br>Basin<br>levee<br>district. | Pontchar-<br>train<br>levee<br>district. | Lake<br>Borgne<br>Basin<br>levee<br>district. | Buras<br>levee<br>district. | Total.       |
| Amount appropriated or allot-<br>ted since (net).....      | \$157,500.00                                                     | \$65,000.00                                     | \$74,500.00                              | \$40,000.00                              | \$25,000.00                                   | \$8,000.00                  | \$370,000.00 |
| Balance unexpended at<br>end of month.....                 | 157,500.00                                                       | 65,000.00                                       | 74,500.00                                | 40,000.00                                | 25,000.00                                     | 8,000.00                    | 370,000.00   |
| From Treasury United States.....                           | 157,500.00                                                       | 65,000.00                                       | 74,500.00                                | 40,000.00                                | 25,000.00                                     | 8,000.00                    | 370,000.00   |
| Amount covered by existing<br>contracts at end of month... | 157,500.00                                                       | 65,000.00                                       | 74,500.00                                | 40,000.00                                | 25,000.00                                     | .....                       | 362,000.00   |
| Balance available at end<br>of month.....                  |                                                                  |                                                 |                                          |                                          |                                               | 8,000.00                    | 8,000.00     |

<sup>1</sup> Total expenditures (\$20,425.82) under this allotment to end of fiscal year 1917, have been distributed to following works: Harbor at New Orleans, La., \$10,499.64; Bondurant, \$2,192.49; Marengo Bend, \$3,462.02; Giles Bend, \$4,271.67.

<sup>2</sup> Bondurant, \$2,192.49; Lafourche levee district, \$25,739.08; Barataria levee district, \$62,236; Lake Borgne levee district, \$41,006; plant, \$108,188.69; harbors at Natchez and Vidalia, Miss. and La., \$194,634; general repairs, and stone (Marengo Bend, \$3,462.02; Giles Bend, \$4,271.67), \$7,733.69.

## Consolidated statement of condition of appropriations and allotments and Mississippi River Commission on June 30, 1918—Continued.

## FOURTH DISTRICT—Continued.

| Appropriations.                                                                     | Expended appropriations.  | Expended contributed funds. | Increase of compensation, rivers and harbors, 1918. | Grand total.  |
|-------------------------------------------------------------------------------------|---------------------------|-----------------------------|-----------------------------------------------------|---------------|
| Amount expended on present project to end of last fiscal year.....                  | <sup>1</sup> \$424,575.30 | <sup>2</sup> \$34,921.02    | .....                                               | \$22,336,387. |
| Balance unexpended at end of last fiscal year.....                                  | .....                     | .....                       | .....                                               | 1,299,044.    |
| Amount appropriated or allotted since (net).....                                    | .....                     | .....                       | \$17,000.00                                         | 1,867,707.    |
| .....                                                                               | .....                     | .....                       | 17,000.00                                           | 3,166,751.    |
| Amount expended from beginning of present fiscal year to end of previous month..... | .....                     | .....                       | <sup>3</sup> 12,316.61                              | 1,302,459.    |
| Amount expended during the month.....                                               | .....                     | .....                       | 1,527.13                                            | 116,374.      |
| .....                                                                               | .....                     | .....                       | 13,843.74                                           | 1,418,834.    |
| Balance unexpended at end of month.....                                             | .....                     | .....                       | 3,153.26                                            | 1,747,916.    |
| In Treasury United States.....                                                      | .....                     | .....                       | 363.61                                              | 1,534,393.    |
| In hand.....                                                                        | .....                     | .....                       | 2,789.65                                            | 163,523.      |
| .....                                                                               | .....                     | .....                       | 3,153.26                                            | 1,747,916.    |
| Outstanding liabilities at end of month.....                                        | .....                     | .....                       | 444.88                                              | 174,792.      |
| Amount covered by existing contracts at end of month.....                           | .....                     | .....                       | .....                                               | 1,103,685.    |
| .....                                                                               | .....                     | .....                       | 444.83                                              | 1,283,477.    |
| Balance available at end of month.....                                              | .....                     | .....                       | 2,711.38                                            | 464,438.      |

<sup>1</sup> Emergencies in river and harbor works (for Giles Bend, Miss., \$40,000; for Old River, \$10,000), \$50,000. Maintaining and protecting levees of the Mississippi River and tributaries against floods (fourth district), \$141,733.32; Atchafalaya River and Bayou des Glaives, \$31,431.05), \$173,217.37. Removing sunk vessels or craft obstructing or endangering navigation, \$9,599. Rebuilding levees of Mississippi River and tributaries damaged by floods (lower Texas levee district, \$8,935.63; Lafourche levee district, \$105,318.56; Lake Borgne levee district, \$551.93; east bank Mississippi River from Vicksburg to Bay Sara, \$23,402.56; sundry breaks Bayou des Glaives and Atchafalaya River, \$55,599.19), \$191,857.93.

<sup>2</sup> Funds contributed for improvement of Mississippi River at Avondale, La., \$32,457.23; funds contributed for improvement of Mississippi River at Torras, La., \$2,453.74.

<sup>3</sup> Amount \$12,333.22, previously reported decreased \$336.61, by reimbursement from board of commissioners, port of New Orleans, La., for constructing and sinking mattress.

APPENDIXES ACCOMPANYING THE ANNUAL REPORT OF THE MISSISSIPPI RIVER COMMISSION FOR THE FISCAL YEAR ENDING JUNE 30, 1918.

*Appendix 1.*

Page.

Report of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission, on works in his charge (13 plates)----- 3521

*Appendix 2.*

Report of Montgomery Gardner, assistant engineer, on operations in first and second districts (20 plates)----- 3580

*Appendix 3.*

Report of A. M. Todd, assistant engineer, on operations in third district (13 plates)----- 3630

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Report of Lieut. Col. G. McC. Derby, United States Army, on operations in fourth district (13 plates)----- 3677

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APPENDIX 1.

IMPROVEMENT MISSISSIPPI RIVER IN CHARGE OF THE SECRETARY,  
MISSISSIPPI RIVER COMMISSION.

REPORT OF E. J. THOMAS, ASSISTANT ENGINEER, SECRETARY MISSISSIPPI RIVER COMMISSION, ASSISTANT ENGINEER IN CHARGE, FOR THE YEAR JUNE 1, 1917, TO MAY 31, 1918.

IMPROVEMENTS, ETC.

1. Mississippi River Commission.
2. Surveys, gauges, and observations.
3. Dredges and dredging.
4. Levees, Cape Girardeau, Mo., to Rock Island, Ill.

1. MISSISSIPPI RIVER COMMISSION.

The duties of the secretary under this allotment consists in payment of salaries and clerical, office, mileage, and miscellaneous expenses of the Mississippi River Commission; in the publication of the official reports and defraying the expenses of the semiannual and other trips of the commission, and the care and repair of the steamer *Mississippi*.

The Mississippi River Commission held four sessions during the year. The one hundred and thirty-ninth was held in St. Louis, Mo.; the one hundred and fortieth at Memphis, Tenn.; the one hundred and forty-first and the one hundred and forty-second on the United States steamer *Mississippi* from St. Louis, Mo., 191 miles above Cairo, to New Orleans, La., 967 miles below Cairo.

The proceedings of these sessions and monthly reports of operations have been printed and issued.

For expenditures, see money statements, pages 3534-3538.

2. SURVEYS, GAUGES, AND OBSERVATIONS.

*Location and description.*—This work covers the Mississippi River from Head of Passes to the headwaters at Lake Itasca, a distance by river of 2,460 miles.

The tributaries and Gulf coast at various places are also included for gauge and observations. Surveys are made of the Mississippi River when ordered by the commission. Discharge measurements are made annually at all of 11 gauging stations on the Mississippi River and 11 stations on tributaries, at which river stages prescribed by the commission are reached during the year.

*Original condition.*—Lack of surveys and physical data made studies of the river incomplete.

*Previous projects.*—Various surveys and examinations have been made and maps published covering portions of the rivers in this district, but no comprehensive project had been adopted previous to the present one.

*Existing project.*—The existing project was adopted by act approved June 28, 1879, which reads in part as follows:

"Sec. 3. It shall be the duty of said commission to direct and complete such surveys of said river, between the Head of the Passes near its mouth to its headwaters as may now be in progress, and to make such additional surveys, examinations, and investigations, topographical, hydrographical, and hydrometrical, of said river and its tributaries as may be deemed necessary; \* \* \*"

*Operations and results during fiscal year.*—The scientific records, maps, and construction drawings of the secretary's office, have been catalogued and carefully indexed. A contract for printing maps of the resurvey of the Mississippi River between high-water banks from Cairo, Ill., to the mouth of Red River, La., a distance of 772 miles by river, was entered into January, 1917. Slow progress has been made on the work of printing—the contract is now about 22 per cent completed.

Bids were invited by advertisement for printing title sheets, index maps etc., for detail charts and inch-to-mile maps above and below Cairo.

The printing of the annual pamphlet for the calendar year 1916, Stages of the Mississippi River and of its Principal Tributaries, in progress at last report, was completed; this pamphlet for the calendar year 1917, now being printed, is 75 per cent completed.

The computation of discharge measurements taken during the year 1917 was completed.

The hourly readings for the calendar year 1917 were scaled and tabulated from the rolls of the automatic tide gauges at Biloxi, Miss., and East Bay, La.

The hydrographs of the Mississippi River and tributaries for calendar year 1917, are being prepared in four sheets for blue printing. A hydrograph of the Mississippi River from Cairo, Ill., to Fort Jackson, La., for the period June 1, 1917, to May 31, 1918, is herewith, designated as plate 1.

The 38 regular gauges in charge of this office on the Mississippi River and tributaries, have been inspected and maintained during the year. Continuous daily readings on these gauges have been observed and reported; and the readings have been tabulated and plotted on the office hydrographs. The automatic tide gauges at Biloxi, Miss., and East Bay, La., and the 185 high-water gauges on the Mississippi River from Cairo, Ill., to Head of Passes, La., have been inspected and maintained during the year.

High-water discharge observations were made at Thebes, Ill., 44.5 miles above Cairo, June 16 to 18, 1917; and at St. Charles, Mo., on the Missouri River, June 14–15, 1917. The discharge of the Mississippi River was measured during low water at Friar Point, Miss. (319), December 25, 1917, Arkansas City, Ark. (438), December 24 to 26, 1917, and at Carrollton, La. (957), January 25 to 30, 1918. The tabulated results of high-water observations made during March–June, 1917, and low-water observations of this year, are printed in Table No. 3, appended hereto.

The reduction of field notes of the Atchafalaya River survey, ordered by the provisions of the river and harbor act of July 27, 1916, having been delayed by reason of depletion of office force by war service, is still in progress.

The expenditures during the year amounted to \$37,007.65.

*Condition at end of fiscal year.*—The general survey was completed in 1905 and maps have been published covering the entire river. Special surveys have been made of the lower river between the mouth of the Ohio River and Carrollton, La. (957), to determine changes in bank line and section; between Cairo, Ill., and Donaldsonville, La. (885), to determine the amount of bank erosion, and at various other localities for the collection of physical data. A survey for the restoration of the permanent marks of the general survey below Cairo, begun at Cairo in the fall of 1905, was completed to Donaldsonville, La. base line, 890.5 miles below Cairo, in January, 1910. A resurvey of the river

tween high-water banks from Cairo to mouth of Red River, a distance of 2 miles by river, begun at Cairo in 1911, was completed in January, 1914. Surveys were completed in February, 1914, in the vicinity of New Orleans, La., in connection with proposed spillways to reduce flood heights. A survey of the Atchafalaya River from Barbre Landing to the junction of the Little Atchafalaya and upper Grand Rivers, was made in 1904-5. The field work of survey of the Atchafalaya River from its head to Morgan City, La., was completed in 1917. Gauges have been established and maintained at various places on the Mississippi River and tributaries and the Gulf of Mexico, and the readings published. Discharge and other observations have been made on the Mississippi River and tributaries at various stations, and the results published in part. Physical data have been compiled and card indexed. Printing maps, scale 1 inch=1 mile, and detail charts, scale 1:20,000, of the resurvey from Cairo, Ill., to the mouth of Red River, La., and reprinting charts and maps, the supply of which is almost exhausted, is in progress. The gauges are being maintained; computation of discharge measurements made in 1917 was completed; and printing of pamphlet, *Stages of the Mississippi River and Its Principal Tributaries During 1917*, is in progress.

The total expenditures to May 31, 1918, amount to \$2,739,096.64. In addition to the foregoing, \$15,000 was expended for spillway surveys.

*Local cooperation.*—None.

*Effect of improvement.*—The surveys, gauge readings, and other observations made and now being made, furnish valuable data for the study of the river in formulating and perfecting plans for improvement.

*Proposed operations.*—It is proposed to publish the maps and charts now ready for publication, maintain gauges, make discharge and other observations, continue the collection and compilation of physical data, and make such other surveys and observations as may from time to time be ordered by the commission.

### 3. DREDGES AND DREDGING.

*Location.*—The portion of the Mississippi River included in this district for dredging extends over about 1,066 miles of river from the mouth of the Ohio River to Head of Passes, La. The lower end of the district is  $13\frac{1}{2}$  miles from the Gulf of Mexico by South Pass and  $19\frac{1}{2}$  miles by Southwest Pass.

*Original condition.*—Depths of 5 and  $5\frac{1}{2}$  feet prevailed during low water on crossings in the upper portion of this district before operations were begun by the United States. Below the mouth of Red River the channel depths were ample for the requirements of navigation to the lower limits of this district.

*Previous projects.*—There had been no project for dredging by the United States in this district previous to the existing project.

*Existing project.*—The existing project was defined in the rivers and harbors act of June 3, 1896, carrying the first appropriation for this work, which was to be expended as follows:

" \* \* \* In the construction of suitable dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down, not less than two hundred and fifty feet in width and nine feet in depth at all periods of the year except when navigation is closed by ice: \* \* \*"

*Operations and results during the year.*—During the low-water season of 1917, four dredges, the *Gamma*, *Iota*, *Henry Flad*, and *B. M. Harrod*, were operated at 10 crossings from Morrissons, 70 miles below Cairo, to Red River Crossing, 766 miles below Cairo.

*Operations and results during the year.*—At the beginning of August the Cairo gauge registered 25 feet, with a continued fall indicated. The *Henry Flad* and *B. M. Harrod* were prepared for service and were started up the river on August 9 and 12, respectively, followed by the *Iota* on August 27 and the *Gamma* on September 25.

The river declined gradually from the 1st of August to September 23, when the gauge at Cairo read 10.4 feet. From September 23 to October 27 the stage varied from 6.7 feet to 10.7 feet. On the latter date a rise set in, which crested at Cairo on November 9 at 19.2 feet, after which the river again declined to below 10 feet to the end of 1917. Navigation was suspended about the middle of December on account of ice. The minimum reading for the season was 4 feet at Cairo and —0.5 feet at Memphis on December 16 and 18, respectively.

The work performed by each dredge and place at which dredging was done are given in table No. 7, accompanying.

The total amount of material moved by all these dredges during the season was 1,327,016 cubic yards.

Twenty-five inspection trips were made with the steamer *Inspector M. R.* over stretches of the river from head of Toney's Chute, 76 miles below Cairo to Vicksburg, 599 miles below Cairo. The least depths found at the various crossings on these trips are given in table No. 5, accompanying.

Eighty-three surveys were made of 24 shoal crossings from Morrissons, 7 miles below Cairo, to Red River Crossing, 766 miles below Cairo. The dimensions of channels determined from the surveys are given in table No. 6 accompanying.

In addition to the above, two surveys were made of harbor at Osceola, Ark. 165 miles below Cairo; three of Tennessee Chute at head of Presidents Island 233 miles below Cairo; and four of entrance to Old River, 764 miles below Cairo.

*Dredging operations, dredge "Gamma."*—The dredge *Gamma* was placed in commission and left the dredge fleet (232) September 25 for Foot of Cow Island Crossing (252). It arrived at this crossing at 7.20 a. m. September 26 and dredging was commenced at 2.10 p. m. on that date. This work was completed at 12.30 p. m. on October 4, when the dredge was moved to the bank to await a lower stage. A considerable amount of stiff mud and coarse gravel was encountered.

The *Gamma* left for the dredge fleet (232) on October 9, for the purpose of filling out the crew. A full complement was secured, with the exception of one fireman, on the 15th, and it departed for Fords Crossing (710) at 12.30 p. m. on that date, arriving there at 8.05 a. m. on the 25th. Dredging was commenced in this crossing at 3.25 p. m. October 25 and was completed at 12.30 p. m. October 30, producing an excellent channel.

The dredge departed for Red River Crossing (766) at 11 a. m. October 31 and arrived at Angola, just above the crossing, at 10.20 a. m. November 1. On completion of survey of Red River Crossing, the *Gamma* left the bank at Angola at 7 a. m. November 2 and moved out into the crossing. Dredging was commenced at 5 p. m. on the 4th. The work in this crossing was completed at 12.30 p. m. on the 7th.

On November 8 at 7.10 a. m. the dredge left the bank in the vicinity of Red River (764) and proceeded upstream, arriving at Natchez (700) at 5.30 p. m. on the 10th, and at Vicksburg, Miss. (599), at 5.40 p. m. on the 15th.

The *Gamma* left Vicksburg at 12 noon November 27 for the mouth of Red River (764), for the purpose of dredging entrance to Old River, and arrived at that point at 4 p. m. on the 30th. After cleaning boilers and making other preparations, the *Gamma* attempted to move into position on December 3, but grounded on the head of the middle bar on account of fog. The dredge was released by the steamer *Sarah Eidenborn*. Dredging was commenced at 5 p. m. December 3 and continued until 6.05 p. m. on the 8th, when the work projected had been completed. On completion of the work the dredge was moved to the bank to await a lower stage of water, and coal.

On December 18 the *Gamma* was moved to Angola incline (764), where an incline which might be received by rail would have to be delivered. Efforts to obtain even a small supply of coal for this dredge by rail delivery proved unsuccessful. The shortage of coal in the lower river interfered with the operation of the *Gamma*. On December 28 the dredge was moved across the river to Red River Landing (765), where a small amount of slack coal had been purchased. On December 27 the steamer *John Ewens* left the dredge fleet towing loaded West Kentucky Coal Barge No. 587 for the *Gamma*, and arrived at the *Gamma* on January 2. The *Gamma* left Angola on January 4 and arrived at Natchez (700) at 2.15 p. m. on the 5th. On account of needed repairs to the stokers, only one battery of boilers could be used. The repairs to the stokers were completed at Natchez January 9, and the *Gamma* left for up the river at 4 p. m. on that date.

On reaching Lake Providence (542) at 4 p. m. January 17, running ice was met and it was necessary for the dredge to tie up above the town, where there was a good ice harbor. It remained at this place until 9.30 a. m. on the 28th when it proceeded upstream. Rosedale, Miss. (398), was reached at 3.45 p. m. February 2 and the *Gamma* tied up there while the heavy ice was passing. On February 10 the river had become clear of ice and at 5.30 a. m. on this date

e towing was resumed, and the dredge and plant arrived at the dredge depot (32) at 2 p. m. on February 15. The crew was disbanded on this date and e draining and laying up of the machinery was commenced.

*Dredge "Iota."*—The *Iota* left the dredge fleet (232) at 5 p. m. August 27 for Drivers Crossing (169) and arrived in the crossing at 12.30 p. m. September 1. dredging was commenced at 12 midnight on the 3d and continued until 10.30 m. on the 8th. On the 10th the dredge was shifted upstream about 700 feet d dredging was commenced in this upper location at 12.30 p. m. and continued til 6.40 a. m. on the 11th, when the dredge was moved out of the crossing id tied to the bank at Osceola Towhead (165), to await a lower stage.

On completion of the work a survey showed that the channel was narrow at e point, and that the cuts should have been extended farther upstream. he dredge was placed in the crossing again September 14, and work continued. til 9 a. m. on the 16th, when the dredge was again moved to the bank to wait a lower stage. The material encountered was sand with a considerable ount of gravel.

The *Iota* was again placed in Drivers Crossing on September 27 and commenced dredging at 2.50 p. m. on that date. The object of this work was the idening of the channel. The work was completed at 5.15 a. m. October 1, hen the dredge was moved to the bank to await a lower stage.

The *Iota* lay at the bank in the vicinity of Osceola (165) awaiting a lower age until October 15, when dredging was commenced in Foot of Island 30 ossing (161). This work was completed at 4 p. m. on the 18th. No further ork was required of the *Iota* and it remained at the bank in this vicinity til 2.30 p. m. November 23, when it left for the dredge fleet and arrived there t 1 p. m. on the 24th.

The *Iota* remained at the bank at the dredge fleet awaiting a lower stage ntil December 3, when it was moved to head of Presidents Island (233) to pen a channel for boats down to the left of the island in Tennessee Chute. his work was commenced at 3.10 p. m. December 3, and completed at 8.30 . m. on the 5th. Gravel was encountered, which rendered progress slow. On ompletion of this work the *Iota* was moved to the dredge fleet, where it remained until it was withdrawn from commission on December 31.

*Dredge "Kappa."*—The *Kappa*, which had been engaged on work in Memphis arbor (230), under direction of the first and second Mississippi River Commission districts, was returned to the dredge fleet on October 23. On October 8, on account of an extended rise in the river stage and the limited supply of oal, the *Kappa* was withdrawn from commission.

*Dredge "Henry Flad."*—The *Flad* was placed in commission and left the dredge fleet (232) August 9 for Plum Point Crossing (164) and arrived there t 9.30 a. m. on the 12th. It left Plum Point Crossing for Blue Grass Crossing (132), where dredging was more urgently needed at 10 a. m. on the 17th and rived at Blue Grass at 12.30 a. m. on the 18th. Dredging was commenced at .30 p. m. on the 19th and continued until 1.40 p. m. on the 22d, when work was uspended on account of shortage of stokers and the necessity for installing ipes for washing light cinders out of the ash chutes. A satisfactory channel was completed for the stage then existing.

The *Flad* was moved to River Styx Crossing (139) on August 23, and on ompletion of the repair work mentioned above and securing a full crew of tokers, commenced dredging at 2.20 p. m. on the 30th. Dredging in River Styx Crossing was completed at 2.45 p. m. on September 12. On September 10 dles were pulled and shifted downstream about 900 feet, in order to extend he cuts through the reef to the lower pool. The material in this crossing was very difficult, as it contained a large percentage of gravel. An excellent hannel was produced with a depth of 11½ feet and more than the project vidth.

On completion of the work in River Styx Crossing, the *Flad* was moved to he bank to await a lower stage, and remained there until 10.40 a. m. September 20, when it departed for Blue Grass Crossing (132), arriving there at 2.20 . m. on the same day. Dredging was commenced at 3.50 p. m. on this date and continued until the 26th, when the dredge was moved out of the channel and tied up to the bank to await a lower stage.

On September 29 the *Flad* was again moved to River Styx Crossing (139) and tied to the bank there to await a lower stage.

The *Flad* departed for Gayoso Crossing (104) at 5.30 a. m. on October 11 and arrived there at 7.50 a. m. on the 12th. Dredging in this crossing was

commenced at 3 p. m. on this date and continued until 2 p. m. on the 20th when the work was completed. The work in Gayoso Crossing was very difficult on account of the form of the bar, which necessitated dredging at an angle with the current.

The *Flad* left Gayoso Crossing (104) at 4.10 p. m. October 20 for the vicinity of foot of Island No. 21 (131) and arrived at Hickmans Light at 8.10 a. m. on the 22d. On the 25th it was moved down to Blue Grass Crossing (132) where dredging was commenced at 7 a. m. on the 26th. This work, which was the removing of lumps and widening of the channel, was completed at 1.1 a. m. on the 28th. The dredge was moved down to the head of River Sty Crossing (139) and tied to the bank there, to await a lower stage, where it remained until November 23, when it was moved to the vicinity of Osceola Ark. (165).

The *Flad* remained at the bank in front of Osceola awaiting a lower stage until December 7, when it was moved up to the shoal which obstructed the entrance to the harbor at Osceola and Luxora. Before completion of the work it was necessary to move the dredge into a harbor which would be protected from floating ice. The work was discontinued at 9.35 a. m. on the 10th and the dredge moved to the bank and tied up.

On December 16 the floating ice gorged just below the *Flad*, deflecting the current in the crossing at the foot of chute of Island No. 30 upstream until it struck directly against the point where the *Flad* was tied to the bank. This forced the free ice in the river above the gorge upstream until it filled the river abreast and above the *Flad* and crowded the dredge out on the bank, damaging her coal barge and wrecking the wheel of the steamer *Venus*, which was alongside. The *Flad* remained in a precarious position, with one corner on the bank, until she was pulled off by the steamer *Wynoka* on December 20. On the 25th the *Flad* was again pushed out on the bank by the extended movement of ice, and the barge, which had been previously damaged, was completely wrecked. One section of the pontoons was broken loose and carried some distance downstream by the ice. The pressure of the ice, however, forced it off the bank and it was later recovered. The *Flad* left the bank below Osceola (165) for the dredge fleet (232) at 8.45 a. m. on December 26 and arrived at 9.15 a. m. on the 27th. The dredge remained at the bank at the dredge fleet until the close of the month and was then withdrawn from commission.

*Dredge "B. M. Harrod."*—The *Harrod* left the dredge fleet (232) on August 12 for Gayoso Crossing (104). It arrived at Caruthersville (110) at 5.15 p. m. on the 15th, where a stop was made to secure additional labor, and left at 9.30 a. m. on the 16th, arriving at Gayoso Landing (104) at 11.45 a. m. on the same day. Dredging was commenced in Gayoso Crossing (104) at 1.15 p. m. August 17 and continued until the 19th.

The *Harrod* was moved down to Caruthersville (110) on August 20 and remained there till 9.45 a. m. September 4, when it returned to Gayoso Crossing (104). Dredging was commenced on September 5 at 4.15 p. m. and continued until 2.20 p. m. on the 6th, when a crack 12 inches in length was discovered in the second sheet from the after end of the starboard boiler of the starboard battery. Repairs were completed September 13, and on this date at 3.1 p. m. dredging was commenced. This work was completed at 11.15 p. m. on September 14, when the dredge was moved to the bank to await a lower stage.

At 7.30 a. m. September 17 the *Harrod* left Gayoso (104) for Point Pleasant (80). Dredging was commenced at 11.30 a. m. on the 18th. This work was continued until 10.30 p. m. on that date, when a crack was discovered in the middle boiler of the port battery in the second seam from the rear end. Dredging was suspended and the dredge moved to the bank at Point Pleasant for repairs. On September 19 instructions were given to attempt to continue dredging, using only two batteries of boilers. This was done on the 20th and the work was completed at 6.15 a. m. on the 22d.

At 10 a. m. on the 22d the dredge departed for Caruthersville (110), arriving there at 2.30 p. m. the same day. On arrival at Caruthersville preparation was made for repairing the cracked boiler shell. These repairs were completed on the 29th; and on the 30th at 8 a. m. the *Harrod* left Caruthersville for Morrissons Crossing (70) and arrived there at 11.45 a. m. October 1. Dredging was commenced at 8.15 p. m. on this date. This work was completed at 11 a. m. October 6.

The *Harrod* left the vicinity of Morrissons Crossing (70) on October 8 at 6.1 a. m. for Point Pleasant Crossing (80) and arrived there at 9 a. m. on the same date. Dredging was commenced at 9.30 a. m. on October 9 and was con-

leted at 5.30 a. m. on the 15th, when the dredge was moved to the bank to wait a lower stage and further instructions.

The *Harrod* left Point Pleasant (80) at 9.10 a. m. October 17 for Caruthersville (110) and arrived there at 1.10 p. m. on the same date.

The *Harrod* left Caruthersville (110) at 11.15 a. m. October 22 for, and arrived at, Gayoso Crossing (104) at 1 a. m. on the same day. Dredging was commenced in this crossing at 6 a. m. on the 23d and continued until 11.15 a. m. on the 25th, when the work projected, which was the enlargement of the lower end of the channel, was completed. The dredge was moved down above Caruthersville (110) to await a lower stage.

The *Harrod* remained at Caruthersville until 6.45 a. m. December 27, when it left for the dredge fleet (232). It arrived at the dredge fleet at 3.30 p. m. on December 28 and was withdrawn from commission on December 31.

Difficulty in securing firemen and dredge hands prevented the operation of the dredges as efficiently as they would have been otherwise. With high wages being paid at Army cantonments and in the cotton fields, it is very difficult to get men to go to or remain on the dredges. On this account it has been with considerable difficulty that the successful maintenance of the project has been accomplished.

*Notes on conditions and results of dredging at each crossing during the low-water season of 1917.*—During the low-water season of 1917 ten crossings were improved by dredging, namely: Morrissons (70), Point Pleasant (80), Gayoso (104), Blue Grass (132), River Styx (139), Chute of Island No. 30, foot (161), Drivers (169), foot of Cow Island (252), Fords (710), and Red River (766). In addition to the above, dredging was done to give access to Osceola Landing (165) and at head of Presidents Island (233) to open up a channel on the left of Presidents Island through Tennessee Chute.

*Morrissons, 70 miles below Cairo.*—This crossing gave little trouble and was dredged only once. The *Harrod* arrived there at 11.45 a. m. October 2, and after cleaning boilers commenced dredging at 8.15 p. m. on this date. The work was completed at 11 a. m. October 6. No further dredging was required.

*Point Pleasant, 80 miles below Cairo.*—The existing channel at this place had commenced to deteriorate when the river reached a comparatively low stage, about the middle of September, and it was deemed advisable to select a new location for the dredged channel. This was done with very satisfactory results and an excellent channel was maintained with two dredgings by the *Harrod*. A considerable amount of mud was encountered.

*Gayoso, 104 miles below Cairo.*—Gayoso was the most troublesome crossing encountered in the 1917 low-water season, on account of the necessity for locating the dredging axis at an angle with the direction of the current. This is always avoided whenever possible, but occasionally conditions arise, owing to the conformation of the river bottom, which leave very little choice in the selection of dredging axis.

This condition usually occurs when the current is parallel, or nearly parallel, to the contours of the reef. Since the dredge cuts must cross these contours, of necessity they must make an angle with them and consequently with the current. The result is that dredging must be repeated several times in a season to remove the material washed into the channel by the cross current.

It was necessary to dredge this crossing four different times, three times with the *Harrod* and once with the *Flad*. It was with considerable difficulty that project depth was maintained.

*Blue Grass, 132 miles below Cairo.*—While no great difficulty was experienced in maintaining a project channel through this crossing it was necessary to dredge it three times. It is possible that better results might have been obtained by locating the axis a little lower down for the first dredging, but this would have doubled, at least, the amount of excavation required. The advantage would have been in the greater possibility of not requiring additional work after the first channel had been completed.

*River Styx, 139 miles below Cairo.*—There was only one possible location for dredging work in this crossing and a very satisfactory channel was obtained by the *Flad*.

*Chute of Island No. 30, foot, 161 miles below Cairo.*—Only a small amount of dredging was required here. The *Iota* was moved into the crossing at foot, chute of Island No. 30, on October 15. Dredging was commenced on this date and completed at 4 p. m. October 18. No further dredging was required in this crossing during the remainder of the low-water season.

*Drivers, 169 miles below Cairo.*—At the beginning of the season there was considerable doubt as to whether the channel at this point would follow the course of previous years and cross the river to Flower Island or return to the Arkansas shore after making a slight detour around the bar below the foot of Bullerton Towhead.

The latter course was selected for improvement, and although a considerable amount of dredging was required, a very satisfactory channel of project depth was maintained through a shoal, which, without improvement, would have been a very serious obstacle to navigation.

In the first dredging in this crossing a wreck of a coal barge was encountered on the right-hand side of the channel, which prevented completion of the work as it was originally planned, making it necessary to do the widening which should have been done on this side, on the opposite side. An excellent channel was produced, however. This wreck was later partially removed by the snag boat *Macomb*.

*Foot of Cow Island, 252 miles below Cairo.*—The *Gamma* arrived in the crossing at 7.20 a. m. September 26 and dredging was commenced at 2.10 p. m. of that date. This work was completed at 12.30 p. m. October 4, when the dredge was moved to the bank to await a lower stage. No further dredging was required in this crossing.

*Fords, 710 miles below Cairo.*—The *Gamma* arrived at Fords Crossing on October 25. Dredging was commenced at 3.25 p. m. The work was completed, producing an excellent channel, at 12.30 p. m. October 30. No further dredging was necessary in this crossing.

Excellent results were obtained by the *Gamma* and a good project channel was maintained. Reports of shoal water in this crossing were refuted by a survey made October 25, which shows that the boats had been running too high.

*Red River, 766 miles below Cairo.*—Map made from survey of November 1-5 shows 8 feet as the best obtainable water through this crossing. Dredging by the *Gamma*, which was commenced on November 3 and completed on the 7th, produced an excellent channel, which required no further work during the remainder of the low-water season.

*Dredge Depot at West Memphis, Ark.*—Buildings and plant on land owned by the United States have been cared for and repaired and work incident to the care of a large fleet and its maintenance in a state of efficiency has been done.

*Plant.*—During the year the following plant, when not in operation, has been cared for at the fleet at West Memphis, Ark.:

Dredges *Beta, Gamma, Delta, Epsilon, Zeta, Iota, Kappa, Henry Flad*, and

*B. M. Harrod*.....

Steamboats *Sachem, Choctaw, Leota, Inspector M. R. C., Mississippi, John*

*Ewens, Saturn, Jupiter, Venus, Vulcan, Mercury*, and *Mars*.....

Pile sinkers Nos. 13, 971, 981, 982, and 983.....

Derrick boat *M. R. C. No. 1*.....

Barges Nos. 041 and 051.....

Pump boat.....

Quarterboat *Wabash No. 3*.....

Gasoline launches.....

Calking flats.....

Sectional dock, sections.....

The *Inspector M. R. C., Saturn, Jupiter, Venus, John Ewens, Vulcan*, and *Mars* were used at different times as fleet tender during the lay-up season.

*Buildings and grounds.*—Buildings and grounds were cared for during the year.

*Marine ways—Repairs.*—Repairs were made during the year, and mud deposited by high water was removed from the gear pits and tracks.

#### OPERATION.

|                                               |           |     |
|-----------------------------------------------|-----------|-----|
| Ways in use.....                              | days..... | 105 |
| Ways idle.....                                | do.....   | 260 |
| Dredge fleet boats docked.....                |           | 5   |
| Plant of other engineer districts docked..... |           | 1   |
| Boats of private concerns docked.....         |           | 1   |

Character and number of craft handled:

|                                                   |            |
|---------------------------------------------------|------------|
| Dredges                                           | 5          |
| Steamboats                                        | 2          |
| Concrete mixers                                   | 1          |
| Total tonnage handled                             | tons—4,351 |
| Maximum load handled at any docking               | do—1,270   |
| Average load handled                              | do—271     |
| Total cost of operation                           | \$318.11   |
| Total cost of repairs                             | 3,799.29   |
| Cost of docking per ton                           | .073       |
| Cost of docking per ton, cost of repairs included | .947       |

*Coal.*—Eight barges of Baker lump coal, containing 4,200 tons, 14 barges of pea and slack containing 6,545.21 tons, and 14 barges of mine run containing 7,500 tons, were purchased from the West Kentucky Coal Co. under contract; 6,227.79 tons of coal were purchased at various places along the river by boats in transit.

The steamer *Mars* with pile sinker No. 983 in tow, left the dredge fleet on June 20 for the United States coal harbor above Caruthersville, Mo. (110). The *Mars* returned to the dredge fleet on June 25. The first delivery of coal by the West Kentucky Coal Co. was made at the United States coal harbor on July 1.

At the close of the dredging season what loaded barges remained at the coal fleet were taken in tow by the dredge *B. M. Harrod* and brought to the dredge fleet, arriving there at 3.30 p. m. December 28. Pile sinker No. 983 was also towed to the dredge fleet by the *Harrod*. The empty barges remaining at the coal fleet at the close of the dredging season were cared for at that place until taken in tow by the towboat *Reaper* on March 20.

The steamer *John Ewens* left the dredge fleet December 27 with loaded West Kentucky coal barge No. 587 for the dredge *Gamma* at Red River and returned to the dredge fleet on January 10.

*Subsistence.*—All employees were furnished subsistence in kind. During the year 83,162 rations were served at a cost of 61.24 cents raw and 72.91 cents served, including wages of cooks, waiters, and all necessary labor in caring for quarters.

*Inspection of floating plant.*—The requirements of the Steamboat-Inspection Service are or will be fully complied with on all floating plant placed in commission for service.

*New plant.*—No new plant was built during the year.

The expenditures during the year amounted to \$319,959.26, all charged to maintenance.

*Condition at end of fiscal year.*—A navigable channel has been maintained since 1895, and a channel of project dimensions has been maintained since 1902, except as follows: For 18 days in 1903 and a few days in 1904 the depths at one bar were 8 and 8½ feet. For a few days there was less than 9 feet at five bars in 1908, seven bars in 1910, five bars in 1914, two bars in 1916, and one bar in 1917. At one bar in 1913 and four bars in 1916 the required width was not maintained.

The project depth of 9 feet with width of 250 feet was exceeded at all bars below Cairo at the end of the year.

The total expenditures to May 31, 1918, amount to \$7,423,242.85.

*Local cooperation.*—None.

*Effect of improvement.*—Continuous navigation of the river below Cairo by river steamboats has been made possible.

*Proposed operations.*—It is proposed to operate as many units of dredging plant as may be necessary to fully maintain the project during the low-water season, to maintain the dredging plant in a state of efficiency, and make bar surveys in connection with dredging operations.

#### 4. LEVEES: CAPE GIRARDEAU, MO., TO ROCK ISLAND, ILL.

*Location and description.*—The portion of the Mississippi River included in this section for levees extends over about 452 miles of river, from Cape Girardeau, Mo., 55 miles above Cairo, to near Rock Island, Ill., 507 miles above Cairo.

The district embraces 13 basins on the west bank of the river with an area of 546 square miles and a river frontage of 228 miles, and 9 basins on the east bank of the Mississippi River with an area of about 708 square miles and a river frontage of 270 miles.

*Original condition.*—The lands adjacent to the river on either side were subject to overflow at high water, the overflow extending from bluffs to bluffs. An area of about 980 square miles was partially protected from overflow by levees constructed by 42 local levee and drainage districts. Fourteen of these local districts, having an area of about 315 square miles with a river frontage of 96 miles, were located on the west bank of the river and 2 districts having an area of about 665 square miles with a river frontage of about 257 miles were located on the east bank. While the expenditures for levees by local districts prior to June 30, 1915, amounted to about \$6,000,000 the levees were not adequate to control the floods that occur at intervals in this portion of the river.

*Previous projects.*—No comprehensive project for levees in this section had been adopted prior to March 4, 1913.

Levee work had been done at three localities previous to the existing project, with a total expenditure by the United States for construction, preservation, and repair of these levees as shown in the statement below:

|                                                        |              |
|--------------------------------------------------------|--------------|
| Flint Creek to Iowa River (430 to 460 <sup>1</sup> R.) | \$346,325.50 |
| Warsaw to Quincy (348 to 381 <sup>1</sup> L.)          | 105,500.00   |
| Sny Island Levee (282 to 335 <sup>1</sup> L.)          | 106,728.90   |

558,554.50

The funds used for work pertaining to these levees were provided by river and harbor acts of July 5, 1884, August 5, 1886, August 11, 1888, September 19, 1890, July 13, 1892, June 3, 1896, and June 13, 1902, and by sundry civil acts of March 2, 1895, and March 3, 1899.

*Existing project.*—The present project is to build or enlarge certain levees to a grade and section sufficient to protect adjacent lands from overflow. This project was adopted in 1913.

Above the mouth of the Missouri River the levees are to be built or enlarged to a section having a crown width of 6 feet with side slopes 1 on 3. The established grade is usually 3 feet above the highest known flood. Below the mouth of the Missouri River the levees are to be built to the standard section crown width of 8 feet, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, thence a banquettes 20 to 40 feet in width, with back slope 1 on 4.

The work has been successful in increasing the amount of protection afforded by the levees.

*Operations and results during year—Rock Island to New Boston, Ill. (507 to 458<sup>1</sup>).*—On May 21, 1918, proposals were opened for constructing 560,000 cubic yards of earthwork (350,000 cubic yards hydraulic fill in old borrow pits and 210,000 cubic yards levee enlargement) between stations 38 and 394 of the levee along the Mississippi River in the Drury drainage district, Illinois (485 to 477<sup>1</sup> L.). The contract was awarded to the La Crosse Dredging Co at 18½ cents per cubic yard. Work under the contract had not commenced prior to May 31, 1918. The levee will be raised to a grade 4½ feet above the high water of 1916.

*Muscatine to mouth of Iowa River, Iowa (481 to 460<sup>1</sup>).*—On July 19, 1917 a contract was entered into with the S. R. H. Robinson & Son Contracting Co. for 160,000 cubic yards of earthwork, reconstructing the Muscatine Island Levee from station 142+50 to station 317, at 15.95 cents per cubic yard. Under this contract 38,378 cubic yards had been placed prior to May 31, 1918.

On May 13, 1918, a contract was entered into with H. G. Armstrong for 250,000 cubic yards of earthwork, reconstructing the Muscatine Island Levee between stations 317 and 535. Work under the Armstrong contract had not commenced prior to May 31, 1918.

The Muscatine Island Levee is about 12 miles in length, extending from the lower limits of the city of Muscatine downstream along the bank of the Mississippi River to Port Louisa, Iowa. At Port Louisa a junction is formed with the levee in Louisa County levee district No. 15, making a continuous levee from Muscatine to the mouth of the Iowa River. The levee in this district is being built to a grade 4½ feet above the high water of 1916.

*Warsaw to Quincy, Ill. (381 to 348<sup>1</sup>).*—Under the contract with Cameron, Joyce & Co., dated September 22, 1914, for enlargement work between stations 0 and 164 of the Hunt Levee (380 to 377<sup>1</sup> L.) a total of 21,856 cubic yards was placed during the year, completing the contract. The total cost of this contract was \$24,876.67.

<sup>1</sup> Miles above Cairo.

On August 29, 1917, a contract was entered into with Cameron, Joyce & Co., or the reconstruction of 95,020 cubic yards of levee embankment between station 164 and station 210 of the Hunt Levee (377 to 376<sup>1</sup> L.) at 28½ cents per cubic yard. This contract was completed at a total cost of \$27,478.55.

On June 3, 1918, proposals were invited by advertisement for continuing the enlargement and reconstruction of the Hunt Levee from station 210 to station 70, the lower limit of the Hunt drainage district. This work will be accomplished by the expenditure of an allotment of \$55,000 from flood-control funds carried by the sundry civil act of June 12, 1917, and \$27,500 contributed by the Hunt drainage district.

*Oquawka to Dallas, Ill. (441 to 414<sup>1</sup>).*—Under the allotment of \$20,000 for levees in this locality from the funds carried by the river and harbor act of July 27, 1916, proposals for construction of earthwork for enlarging a part of the levee along the Mississippi River in Henderson County drainage district No. 1, Illinois, were invited three times by advertisement but no bids were received.

*Mouth of Des Moines River to La Grange, Mo. (381 to 356<sup>1</sup>).*—Fourteen thousand four hundred dollars from the allotment of \$20,000 for levees in this locality from flood-control funds carried by the sundry civil act of June 12, 1917, and \$7,200 contributed by the Gregory drainage district, Missouri, are being expended in reconstructing the levee along the Mississippi River in the Gregory drainage district, Missouri, from station 0 to station 39. On October 31, 1917, a contract was entered into with Cameron, Joyce & Co., for the construction of 47,317 cubic yards of earthwork at 43 cents per cubic yard. Under this contract 46,192 cubic yards had been placed prior to May 31, 1918.

The Gregory drainage district embraces 8,000 acres of land in the basin between Fox River and the bluffs above Canton, Mo. (375 to 369<sup>1</sup> R.). The levee in the district along the Mississippi River is about 6 miles in length and will be raised to a grade 3 feet above the high water of 1851.

*Quincy to Hamburg Bay, Ill. (348 to 282<sup>1</sup>).*—On September 17, 1914, a contract was entered into with the Bondurant Construction Co. for 132,900 cubic yards of earthwork between stations —18 and 482 of the Sny Levee (335 to 326<sup>1</sup> L.) at 32½ cents per cubic yard. This contract was annulled during the fiscal year ending June 30, 1917, and work was continued by the United States with hired teams. During the year a total of 52,879 cubic yards was placed at a cost of \$24,983.44, approximately 47 cents per cubic yard. An additional 6,347 cubic yards will be required to complete the work contemplated under the Bondurant contract.

On April 22, 1918, proposals were invited by advertisement for the construction of 350,000 cubic yards of earthwork between stations 380 and 740 of the Sny Levee (328 to 322<sup>1</sup> L.) but no proposals were received in response to the advertisement.

*La Grange to Mouth of Missouri River, Mo. (357 to 208<sup>1</sup>).*—The contract with Fred C. Morgan for earthwork on the Riverland Levee unfinished at the end of the previous year, was completed. A total of 107,091 cubic yards was placed under this contract during the year, at a cost to the United States of \$16,084.16. The total cost of this contract was \$19,985.85.

On October 19, 1917, a contract was entered into with the S. R. H. Robinson & Son Contracting Co. for 560,000 cubic yards of earthwork between stations 82 and 305 of the Riverland Levee (311 to 305<sup>1</sup> R.) at 15 cents per cubic yard. A total of 51,180 cubic yards had been placed under this contract prior to May 31, 1918. The levee is being raised to a grade 3 feet above the high water of 1851.

This work is being accomplished by the expenditure of \$66,000 from the allotment of \$70,000 for levees in this locality from flood-control funds carried by the sundry civil act of June 12, 1917, and \$33,000 contributed by the Riverland levee district.

*Head of Chouteau Island to Prairie du Pont, Ill. (208 to 185<sup>1</sup>).*—The work of closing a gap between stations 886 and 895 of the front levee in the East Side levee and sanitary district, Ill., under contract with the Hillsboro Dradging Co. and unfinished at the end of the previous year, was completed on September 29, 1917. A total of 34,824 cubic yards was placed during the year at a cost of \$13,100.01 to the United States. The total cost of this contract was \$13,900. The front levee in this district is now completed to the project grade and section.

<sup>1</sup> Miles above Cairo.

After completion of the levee work the unexpended balance of \$11,100 was reallocated as follows:

## Levees:

|                                             |         |
|---------------------------------------------|---------|
| Muscatine to mouth of Iowa River, Iowa----- | \$5,500 |
| Warsaw to Quincy, Ill-----                  | 5,600   |

*St. Louis to Cape Girardeau, Mo. (191 to 54<sup>1</sup>).—*The allotment of \$50,000 for levees in this locality from flood-control funds carried by the sundry civil act of June 12, 1917, was reallocated to levees as follows:

|                                                         |          |
|---------------------------------------------------------|----------|
| Grand Tower to Gale, Ill. (84 to 48 <sup>1</sup> )----- | \$25,000 |
| Warsaw to Quincy, Ill. (380 to 348 <sup>1</sup> )-----  | 25,000   |

*Prairie du Pont to Grand Tower, Ill. (185 to 84<sup>1</sup>).—*The allotment of \$55,000 for levees in this locality from flood-control funds carried by the sundry civil act of June 12, 1917, was reallocated to levees, Rock Island to New Boston, Ill. (510 to 460<sup>1</sup>).

*Grand Tower to Gale, Ill. (84 to 48<sup>1</sup>).—*Levee reconstruction between stations 69 and 181 of the East Cape Girardeau Levee (57 to 60<sup>1</sup> L.) unfinished at the end of the previous year, was completed. A total of 59,699 cubic yards was placed during the year, under this contract, at a cost of \$10,074.31. The total cost of this contract was \$14,417.47.

On November 23, 1917, a contract was entered into with McCann Bros. for 20,000 cubic yards of earthwork between stations 179 and 202 of the East Cape Girardeau Levee (57<sup>1</sup> L.) at 24 cents per cubic yard. Work under this contract commenced on May 16, 1918, and a total of 1,628 cubic yards had been placed prior to May 31, 1918.

On April 8, 1918, a contract was entered into with Cameron, Joyce & Co. for 100,000 cubic yards of earthwork between stations 202 and 330, of the East Cape Girardeau Levee, at 29½ cents per cubic yard. Work under this contract commenced on May 18, 1918, and 7,936 cubic yards had been placed prior to May 31, 1918. Funds for continuing the reconstruction and enlargement of the East Cape Girardeau Levee downstream from station 202 are provided by the allotment of \$25,000 from flood-control funds, the transfer of \$25,000 from levees, St. Louis to Cape Girardeau, to levees in this locality and \$25,000 contributed by the East Cape Girardeau and Clear Creek drainage district.

The expenditures on levees during the year June 1, 1917, to May 31, 1918, are summarized in the following table:

| Locality.                                                       | Miles above<br>Cairo. | Amount<br>expended. |
|-----------------------------------------------------------------|-----------------------|---------------------|
| Drury drainage district, Ill.....                               | 485 to 477            | \$247.42            |
| Muscatine Island levee district, Iowa.....                      | 481 to 460            | 5,082.62            |
| Henderson County drainage district No. 1, Ill.....              | 428 to 436            | 262.04              |
| Hunt drainage district, Ill.....                                | 380 to 369            | 34,192.67           |
| Gregory drainage district, Mo.....                              | 375 to 369            | 12,494.93           |
| Sny Island levee drainage district, Ill.....                    | 335 to 282            | 25,295.88           |
| Riverland levee district, Mo.....                               | 312 to 305            | 21,397.44           |
| East Side levee and sanitary district, Ill.....                 | 208 to 185            | 13,440.71           |
| East Cape Girardeau and Clear Creek drainage district, Ill..... | 61 to 48              | 12,502.35           |
| Total.....                                                      |                       | 124,916.06          |

For abstract of contracts in force see page 3539.

*Condition at the end of the fiscal year.*—For complete report on examination of this district by the Mississippi River Commission with recommendations, see H. R. Doc. 628, Sixty-third Congress, second session.

A total of 1,160,000 cubic yards of earthwork have been placed. Two million seven hundred and twenty-five thousand cubic yards are still required to complete the work under approved subprojects. Twenty-four miles of levee embankment have been completed to the commission grade and section. The total expenditures by the United States under the project to May 31, 1918, are summarized in the following statement:

|                                                    |          |
|----------------------------------------------------|----------|
| Drury drainage district, Ill-----                  | \$510.26 |
| Muscatine Island levee district, Iowa-----         | 5,555.61 |
| Henderson County drainage district No. 1, Ill----- | 907.40   |

|                                                             |             |
|-------------------------------------------------------------|-------------|
| Hunt drainage district, Ill.                                | \$52,339.61 |
| Gregory drainage district, Mo.                              | 12,494.93   |
| Sny Island levee drainage district, Ill.                    | 50,066.82   |
| Elsberry drainage district, Mo.                             | 37,753.81   |
| Riverland levee district, Mo.                               | 21,732.49   |
| East Side levee and sanitary district, Ill.                 | 73,900.00   |
| East Cape Girardeau and Clear Creek drainage district, Ill. | 24,522.49   |

Total 279,783.42

*Local cooperation.*—The expenditures for levees by local levee boards in localities where expenditures have been made or proposed by the United States under this project are shown by the following statement:

|                                                             |              |
|-------------------------------------------------------------|--------------|
| Drury drainage district, Ill.                               | \$156,913.79 |
| Muscatine Island levee district, Iowa.                      | 76,471.14    |
| Henderson County drainage district No. 1, Ill.              | 116,812.99   |
| Hunt drainage district, Ill.                                | 272,800.00   |
| Gregory drainage district, Mo.                              | 92,091.70    |
| Sny Island levee drainage district, Ill.                    | 1,517,911.77 |
| Riverland levee district, Mo.                               | 56,186.34    |
| Elsberry drainage district, Mo.                             | 233,141.65   |
| East Side levee and sanitary district, Ill.                 | 3,335,641.97 |
| East Cape Girardeau and Clear Creek drainage district, Ill. | 144,778.30   |

Total 6,002,749.65

In addition to the expenditures tabulated above, contributions of funds for flood control have been made during the fiscal year as follows:

|                                                             |             |
|-------------------------------------------------------------|-------------|
| Drury drainage district, Ill.                               | \$27,500.00 |
| Muscatine Island levee district, Iowa.                      | 15,000.00   |
| Hunt drainage district, Ill.                                | 27,500.00   |
| Gregory drainage district, Mo.                              | 7,200.00    |
| Riverland levee district, Mo.                               | 33,000.00   |
| East Cape Girardeau and Clear Creek drainage district, Ill. | 25,000.00   |

Total 135,200.00

*Effect of improvement.*—Added protection against overflow has been given to about 222,000 acres of land.

*Proposed operations.*—Continuation of the enlargement and reconstruction of levees at the rate that funds made available will permit. Expenditures under existing contracts, during the season when river and weather conditions will permit work, will be at the rate of \$50,000 per month until January 1, 1919, and \$30,000 per month from January 1 to June 30, 1919. An additional \$10,000 per month will be expended on contracts being advertised but not yet awarded, or by accomplishing levee enlargement in the Sny Island levee drainage district and in Henderson County drainage district No. 1 by hired plant and labor.

The following papers and plates accompany this report:

Money statements.

Abstract of contracts in force.

Commercial statistics.

Statement of charts issued and sold.

Table No. 1. Highest and lowest gauge readings in 1917, Mississippi River and tributaries.

Table No. 2. Highest gauge readings of 1918, Mississippi River and tributaries.

Table No. 3. Results of discharge observations, Mississippi River and tributaries.

Table No. 4. Cost of dredging operations, May 1, 1917, to April 30, 1918.

Table No. 5. Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1917.

Table No. 6. Dimensions of channels through bars, Mississippi River below Cairo, dredging season of 1917.

Table No. 7. Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1917.

Plate No. 1. Hydrograph of Mississippi River, Cairo, Ill., to Fort Jackson La., June 1, 1917, to May 31, 1918.

Plate No. 2. Profile of Drury Levee.

Plate No. 3. Profile of Muscatine Island Levee.

Plate No. 4. Profile of levee in Henderson County drainage districts Nos. 1 and 2, Illinois.

Plate No. 5. Profile of Hunt and Lima Lake Levee.

Plate No. 6. Profile of Gregory Levee.

Plate No. 7. Profile of Sny Island Levee.

Plate No. 8. Profile of Riverland levee.

Plate No. 9. Profile of Front Levee, East Side Levee, and sanitary district.

Plate No. 10. Profile of East Cape Girardeau Levee.

Plate No. 11. Location of levee work, Rock Island to Nauvoo.

Plate No. 12. Location of levee work, Nauvoo to Alton.

Plate No. 13. Location of levee work, Alton to Thebes.

Appendix 1A. Laws affecting the Mississippi River Commission July 1, 1917 to June 30, 1918.

E. J. THOMAS,

*Assistant Engineer, Secretary Mississippi River Commission.*

### MONEY STATEMENTS.

#### APPROPRIATION FOR MISSISSIPPI RIVER.

|                                                                                                                                                                                        |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended                                                                                                                                                       | \$478, 169. 80 <sup>1</sup> |
| Amount received from sale of coal credited under the provisions of section 5 of river and harbor act of June 13, 1902, in June, 1918, to allotment for "Dredges and dredging"          | \$271. 19                   |
| Amount received in December, 1917, for rental of steamboat <i>Nokomis</i> (ED 114290-3, Sec. MRC 2438-11) credited to allotment for "Dredges and dredging"                             | 1, 220. 00                  |
| Amount received in January, 1918, for rental of steamboats <i>Nokomis</i> and <i>Sachem</i> (ED 114290-3, Sec. MRC 2438-11) credited to allotment for "Dredges and dredging"           | 2, 260. 00                  |
| Amount received in April, 1918, for rental of steamboat <i>Leota</i> (Sec. MRC. 2557-12) credited to allotment for "Dredges and dredging"                                              | 805. 00                     |
| Amount received in May, 1918, for rental of steamboat <i>Leota</i> (ED 93650-23, Sec. MRC. 2557-12) credited to allotment for "Dredges and dredging"                                   | 910. 00                     |
| Amount received in May, 1918, for docking steamer <i>Eclipse</i> (ED 78130-29, Sec. MRC 2045-29) credited to allotment for "Dredges and dredging"                                      | 842. 90                     |
| Amount received in May, 1918, from collection of stoppage against pay of a United States employee for destruction of public property, credited to allotment for "Dredges and dredging" | 19. 33                      |

<sup>1</sup> The amount, \$476,423.58, reported in annual report for 1917, has been increased \$1,746.31, as follows:

Increased by refundments—

November, 1917, voucher 151, March, 1917 (to surveys, gages and observations)-----\$1. 15

November, 1917, vouchers 1 and 4, March, 1917 (to dredges and dredging)-----16. 01

Increased by reimbursement from St. Louis district office for coal, credited to allotment for "dredges and dredging" (ED 104197-723)-----\$17. 10

Increased by reimbursement from U. S. Engineer office, Little Rock, Ark., for repairs to dredge *H. S. Taber*, credited to allotment for "dredges and dredging" (ED 104197-1610)-----451. 20

1, 277. 80

1, 746. 31

|                                                                                                                                                                                                                              |              |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| amount received in June, 1918, for rental or dredge <i>Delta</i> , steamboats <i>Leota</i> and <i>Saturn</i> and pilesinker No. 983 (ED 104197-2251, Sec. MRC 1615-70) credited to allotment for "Dredges and dredging"----- | \$3, 628. 76 |              |
|                                                                                                                                                                                                                              |              | \$9, 957. 18 |
| June 30, 1918, amount expended during fiscal year-----                                                                                                                                                                       |              | 488, 127. 07 |
|                                                                                                                                                                                                                              |              | 290, 662. 20 |
| July 1, 1918, balance unexpended-----                                                                                                                                                                                        |              | 197, 464. 87 |
| July 1, 1918, outstanding liabilities-----                                                                                                                                                                                   | 4, 056. 98   |              |
| July 1, 1918, amount covered by uncompleted contracts--                                                                                                                                                                      | 57, 325. 44  |              |
|                                                                                                                                                                                                                              |              | 61, 382. 42  |
| July 1, 1918, balance available-----                                                                                                                                                                                         |              | 136, 082. 45 |

APPROPRIATION FOR MAINTENANCE AND IMPROVEMENT OF EXISTING RIVER AND HARBOR WORKS.

|                                                                                                                                                                                                                                                                                                                                                           |                             |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| July 1, 1917, balance unexpended-----                                                                                                                                                                                                                                                                                                                     | <sup>1</sup> \$111, 489. 75 |              |
| Amount transferred in May, 1918, to allotment "Upper St. Francis levee district" first and second Mississippi River Commission districts, by resolution of the Mississippi River Commission, April 6, 1918, approved by the Chief of Engineers April 15, 1918. (ED 15927-576.) (Act of Oct. 2, 1914, \$1,637.28; act of Mar. 4, 1915, \$109,852.47) ----- |                             | 111, 489. 75 |

APPROPRIATION FOR FLOOD CONTROL, MISSISSIPPI RIVER, AND SACRAMENTO RIVER, CAL.

|                                                                                                                                                                                                                                                                                                                                                       |                |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------|
| July 1, 1917, balance unexpended-----                                                                                                                                                                                                                                                                                                                 |                | \$0. 00      |
| Amount allotted from appropriation by sundry civil act of June 12, 1917, approved by the Chief of Engineers, Aug. 7, 1917 ("Mississippi River Commission," \$50,000; "Surveys, gauges, and observations," \$40,000; "Dredges and dredging," \$350,000; "New steamer," \$196,000; "Levees, Cape Girardeau, Mo., to Rock Island, Ill.," \$280,000)----- | \$916, 000. 00 |              |
|                                                                                                                                                                                                                                                                                                                                                       |                | 916, 000. 00 |
| June 30, 1918, amount expended during fiscal year-----                                                                                                                                                                                                                                                                                                |                | 235, 486. 92 |
| July 1, 1918, balance unexpended-----                                                                                                                                                                                                                                                                                                                 |                | 680, 513. 08 |
| July 1, 1918, outstanding liabilities-----                                                                                                                                                                                                                                                                                                            | 107, 604. 39   |              |
| July 1, 1918, amount covered by uncompleted contracts--                                                                                                                                                                                                                                                                                               | 144, 617. 84   |              |
|                                                                                                                                                                                                                                                                                                                                                       |                | 252, 222. 23 |
| July 1, 1918, balance available-----                                                                                                                                                                                                                                                                                                                  |                | 428, 290. 85 |

APPROPRIATION FOR GAUGING WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.<sup>2</sup>

|                                                                                                                                                                                                              |                           |             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|
| July 1, 1917, balance unexpended-----                                                                                                                                                                        | <sup>3</sup> \$1, 776. 36 |             |
| Amount allotted by Chief of Engineers, from permanent annual appropriation made by section 6 of river and harbor act of Aug. 11, 1888, as amended by section 9 of river and harbor act of June 13, 1902----- |                           | 9, 100. 00  |
|                                                                                                                                                                                                              |                           | 10, 876. 36 |

<sup>1</sup> The amount, \$111,489.66, reported in annual report for 1917, has been increased \$0.09 by refundment of overpayment November, 1917, on voucher 86, January, 1917, credited to allotment for "dredges and dredging."

<sup>2</sup> The custody and care of the gauges maintained under this appropriation were assumed by the Mississippi River Commission Feb. 11, 1901, on which date they were transferred to the secretary, under authority of Secretary of War, dated Jan. 25, 1901.

<sup>3</sup> The amount, \$1,771.69, reported in annual report for 1917, has been increased \$4.67 by the secretary, by refundment of overpayment on voucher 107, June, 1917.

## 3536 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

|                                                                                 |            |            |
|---------------------------------------------------------------------------------|------------|------------|
| June 30, 1918, amount expended during fiscal year----                           | \$8,217.85 |            |
| June 30, 1918, amount reverted to Treasury during fiscal year-----              | 860.84     | \$9,078.69 |
| July 1, 1918, balance unexpended-----                                           |            | 1,797.69   |
| July 1, 1918, outstanding liabilities-----                                      |            | 1,797.69   |
| Amount that can be profitably expended in fiscal year ending June 30, 1920----- |            | 9,100.00   |

## ITEMIZED STATEMENT OF EXPENDITURES DURING THE FISCAL YEAR ENDING JUNE 30, 1918, SUBMITTED IN COMPLIANCE WITH REQUIREMENT OF SECTION 6 OF RIVER AND HARBOR ACT OF AUG. 11, 1888.

## Observations:

|                                                                                            |            |            |
|--------------------------------------------------------------------------------------------|------------|------------|
| Pay of permanent gauge observers-----                                                      |            | \$3,548.00 |
| Inspections and repairs:                                                                   |            |            |
| Inspection of gauges on Mississippi River by junior engineers and parties on steamers----- | \$1,877.93 |            |
| Inspection of gauges on tributaries-----                                                   | 109.41     |            |
| Renewals and repairs of gauges and bulletins-----                                          | 93.70      |            |
|                                                                                            |            | 2,081.04   |
| Office expenses and contingencies:                                                         |            |            |
| Pay of assistant and junior engineers, surveyors, and clerks-----                          | 1,980.23   |            |
| Stationery, printing, office rent, etc-----                                                | 608.58     |            |
|                                                                                            |            | 2,588.81   |
| Total-----                                                                                 |            | 8,217.85   |

## APPROPRIATION FOR GAUGING THE WATERS OF THE MISSISSIPPI RIVER AND ITS TRIBUTARIES.

## Allotments from general appropriations for examinations, surveys, and contingencies of rivers and harbors by acts of—

|                                                      |            |
|------------------------------------------------------|------------|
| Mar. 3, 1871 (allotment Apr. 11, 1871)-----          | \$5,000.00 |
| June 10, 1872 (allotment July 11, 1872)-----         | 5,000.00   |
| Mar. 3, 1873 (allotment May 17, 1873)-----           | 5,000.00   |
| June 23, 1874 (allotment July 29, 1874)-----         | 5,000.00   |
| Mar. 3, 1875 (allotment Mar. 22, 1875)-----          | 5,000.00   |
| Specific appropriations by river and harbor acts of— |            |
| Aug. 14, 1876-----                                   | 5,000.00   |
| June 18, 1878-----                                   | 5,000.00   |
| Mar. 3, 1879-----                                    | 5,000.00   |
| June 14, 1880-----                                   | 5,000.00   |
| Mar. 3, 1881-----                                    | 5,000.00   |
| Aug. 2, 1882-----                                    | 5,000.00   |
| Deficiency act of Mar. 12, 1884-----                 | 2,100.00   |

## Specific appropriations by river and harbor acts of—

|                   |          |
|-------------------|----------|
| July 5, 1884----- | 5,000.00 |
| Aug. 5, 1886----- | 5,000.00 |

## Allotted from specific appropriation by river and harbor act of Aug. 11, 1888 (allotment Oct. 17, 1888)-----

|  |          |
|--|----------|
|  | 8,700.00 |
|--|----------|

## Deficiency act of Oct. 19, 1888-----

|  |          |
|--|----------|
|  | 3,600.00 |
|--|----------|

## Allotments from permanent indefinite appropriation made by section 6 of river and harbor act of Aug. 11, 1888, for fiscal years, viz:

|                                                                                                                                                                  |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1890 (allotment Aug. 23, 1889)-----                                                                                                                              | 9,000.00 |
| 1891 (allotment Aug. 19, 1890, \$8,700, less \$3,518.34 withheld in United States Treasury under ruling that only \$6,000 can be expended each fiscal year)----- | 5,181.66 |
| 1892 (allotment July 17, 1891)-----                                                                                                                              | 5,100.00 |
| 1893 (allotment July 15, 1892)-----                                                                                                                              | 5,500.00 |
| 1894 (allotment July 18, 1893)-----                                                                                                                              | 5,500.00 |
| 1895 (allotment June 5, 1894)-----                                                                                                                               | 5,500.00 |
| 1896 (allotment June 4, 1895)-----                                                                                                                               | 5,500.00 |

|                                                                       |             |
|-----------------------------------------------------------------------|-------------|
| 1897 (allotment May 13, 1896)-----                                    | \$, 500. 00 |
| 1898 (allotment June 16, 1897)-----                                   | 5, 500. 00  |
| 1899 (allotments May 27, 1898, \$5,500; July 12, 1898, \$500.00)----- | 6, 000. 00  |
| 1900 (allotment June 1, 1899)-----                                    | 5, 500. 00  |
| 1901 (allotment July 2, 1900)-----                                    | 6, 000. 00  |
| 1902 (allotment July 31, 1901)-----                                   | 6, 000. 00  |

otments from permanent annual appropriation made by section 6  
of river and harbor act of Aug. 11, 1888, as amended by section 9  
of river and harbor act of June 13, 1902, for fiscal years, viz:

|                                                                                                                 |            |
|-----------------------------------------------------------------------------------------------------------------|------------|
| 1903 (allotment July 23, 1902, \$9,600, less \$500 allotted Aug. 2,<br>1902, to St. Paul, Minn., district)----- | 9, 100. 00 |
| 1904 (allotment Apr. 18, 1903)-----                                                                             | 9, 100. 00 |
| 1905 (allotment Aug. 11, 1904)-----                                                                             | 9, 100. 00 |
| 1906 (allotment June 30, 1905)-----                                                                             | 9, 100. 00 |
| 1907 (allotment July 2, 1906)-----                                                                              | 9, 100. 00 |
| 1908 (allotment July 24, 1907)-----                                                                             | 9, 100. 00 |
| 1909 (allotment July 3, 1908)-----                                                                              | 9, 100. 00 |
| 1910 (allotment July 13, 1909)-----                                                                             | 9, 100. 00 |
| 1911 (allotment July 27, 1910)-----                                                                             | 9, 600. 00 |
| 1912 (allotment Feb. 7, 1911)-----                                                                              | 9, 100. 00 |
| 1913 (allotment May 29, 1912)-----                                                                              | 9, 100. 00 |
| 1914-----                                                                                                       | 9, 100. 00 |
| 1915 (allotment Sept. 2, 1914)-----                                                                             | 9, 100. 00 |
| 1916 (allotment July 28, 1915)-----                                                                             | 9, 100. 00 |
| 1917 (allotment Aug. 3, 1916)-----                                                                              | 9, 100. 00 |
| 1918 (allotment June 27, 1917)-----                                                                             | 9, 100. 00 |

Total----- 301, 281. 66

*Expended.*

|                                             | To June 30,<br>1917. | During year<br>ending<br>June 30, 1918. | Total.         |
|---------------------------------------------|----------------------|-----------------------------------------|----------------|
| penditures.....                             | \$272, 306. 36       | \$8, 217. 85                            | \$280, 524. 21 |
| expended balances reverted to Treasury..... | 18, 098. 94          | 860. 84                                 | 18, 959. 78    |
| Total.....                                  | 290, 405. 30         | 9, 078. 69                              | 299, 483. 99   |
| expended balance June 30, 1918.....         |                      |                                         | 1, 797. 67     |
| Total appropriated, etc.....                |                      |                                         | 301, 281. 66   |

The amount \$272,312.08, reported in annual report for 1917, has been decreased \$5.72 by refundments  
overpayment by the Secretary and to correct clerical error, as follows:

|                                          |         |
|------------------------------------------|---------|
| July, 1917, voucher 107, June, 1917..... | \$4. 67 |
| To correct clerical error.....           | 1. 05   |
|                                          | 5. 72   |

FUNDS CONTRIBUTED BY LOCAL LEVEE DISTRICTS FOR FLOOD CONTROL,  
MISSISSIPPI RIVER, IN ACCORDANCE WITH SUNDRY CIVIL ACT, JUNE  
12, 1917.

|                                                                 |              |
|-----------------------------------------------------------------|--------------|
| or levees, Cape Girardeau, Mo., to Rock Island, Ill-----        | 135, 200. 00 |
| June 30, 1918, amount expended during fiscal year-----          | 8, 664. 50   |
| July 1, 1918, balance unexpended-----                           | 126, 535. 50 |
| July 1, 1918, outstanding liabilities-----                      | \$2, 920. 39 |
| July 1, 1918, amount covered by uncompleted con-<br>tracts----- | 72, 269. 23  |
|                                                                 | 75, 189. 62  |
| July 1, 1918, balance available-----                            | 51, 345. 88  |

## APPROPRIATION FOR WATERWAY FROM LOCKPORT, ILL., TO ST. LOUIS, MO.

|                                                                                                                                                |             |           |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------|
| Act of June 13, 1902 (river and harbor)-----                                                                                                   |             | 25,000.00 |
| Amount transferred from allotment for "Survey of Illinois and Des<br>Plaines Rivers, Ill.," as reimbursement-----                              |             | 1,093.40  |
| Total-----                                                                                                                                     |             | 26,093.40 |
| Expended to June 30, 1906-----                                                                                                                 | \$22,291.23 |           |
| Unexpended balance carried to surplus fund on June<br>30, 1909, under the provisions of section 10 of<br>sundry civil act of Mar. 4, 1909----- | 3,802.17    |           |
|                                                                                                                                                |             | 26,093.40 |

APPROPRIATION FOR CLAIMS FOR DAMAGES BY COLLISION, RIVER AND  
HARBOR WORKS.

|                                                |  |        |
|------------------------------------------------|--|--------|
| Act of Apr. 6, 1914 (urgent deficiency)-----   |  | 58.80  |
| Expended in fiscal year 1914-----              |  | 58.80  |
| Act of Sept. 8, 1916 (general deficiency)----- |  | 427.80 |
| Expended in fiscal year 1917-----              |  | 427.80 |

| Contractor.                          | Character of work and locality.                                         | Cubic yards in contract. | Price.                      | Date of contract. | Date of approval. | Date of beginning work. | Date of expiration.        | Percentage of completion. |
|--------------------------------------|-------------------------------------------------------------------------|--------------------------|-----------------------------|-------------------|-------------------|-------------------------|----------------------------|---------------------------|
| Combustion Engineering Corporation.  | Mechanical stokers on dredge B. M. Harrod.                              |                          | \$9,150.                    | Apr. 7, 1916      | May 3, 1916       | May 16, 1916            | Oct. 12, 1916 <sup>1</sup> | 2 100                     |
|                                      | Mechanical stokers on dredge Henry Flad.                                |                          | \$6,850.                    |                   |                   |                         |                            | 2 100                     |
| International Building Co.           | Lease of offices and storage rooms.                                     |                          | \$6,724 per annum.          | June 28, 1917     | Emergency         | July 1, 1917            | June 30, 1918              | 100                       |
| Southwestern Bell Telephone Co.      | Telephone service.                                                      |                          | \$96 per annum.             | June 29, 1917     | do.               | do.                     | do.                        | 100                       |
|                                      | Two extension telephone desk sets.                                      |                          | \$36 per annum.             | do.               | do.               | do.                     | do.                        | 100                       |
|                                      | Cut-out switch.                                                         |                          | \$2 per annum.              | do.               | do.               | do.                     | do.                        | 100                       |
|                                      | One extension telephone desk set.                                       |                          | \$18 per annum.             | July 23, 1917     | do.               | July 25, 1917           | do.                        | 100                       |
| Cumberland Telephone & Telegraph Co. | Telephone service at West Memphis, Ark.                                 |                          | \$78 per annum.             | June 29, 1917     | do.               | July 1, 1917            | do.                        | 100                       |
| Lloyd W. Lang, trustee.              | Lease of water-front privileges at West Memphis, Ark.                   |                          | \$150 per annum.            | June 23, 1917     | do.               | do.                     | do.                        | 100                       |
| Chas. W. Hunter.                     | 3,580 tons screened lump coal.                                          |                          | \$100 per annum.            | do.               | do.               | do.                     | do.                        | 100                       |
| West Kentucky Coal Co.               | 6,250 tons mine run coal.                                               |                          | \$4.05 per ton.             | Mar. 15, 1917     | May 4, 1917       | May 10, 1917            | do.                        | 3 100                     |
|                                      | 4,000 tons pea and slack coal.                                          |                          | \$3.20 per ton.             | do.               | do.               | do.                     | do.                        | 3 100                     |
| A. Hoen & Co.                        | 31,500 detail charts.                                                   |                          | \$3.20 per ton.             | do.               | do.               | do.                     | do.                        | 3 100                     |
|                                      | 3,000 detail charts.                                                    |                          | \$18 per 100 sheets.        | Jan. 17, 1917     | Feb. 7, 1917      | Feb. 14, 1917           | Aug. 14, 1917 <sup>1</sup> | 35                        |
|                                      | 11,500 inch-mile maps.                                                  |                          | \$35 per 100 sheets.        | do.               | do.               | do.                     | do.                        | 25                        |
|                                      | 600 inch-mile maps.                                                     |                          | \$10 per 100 sheets.        | do.               | do.               | do.                     | do.                        | 25                        |
| Cameron, Joyce & Co.                 | Levee work, Hunt drainage district, Ill.                                | 96,274                   | \$12 per 100 sheets.        | do.               | do.               | do.                     | do.                        | 25                        |
|                                      | do.                                                                     |                          | 20.50 cents per cubic yard. | Sept. 22, 1914    | Oct. 15, 1914     | Oct. 27, 1914           | Dec. 31, 1915 <sup>1</sup> | 2 100                     |
|                                      | do.                                                                     |                          | 28.50 cents per cubic yard. | Aug. 29, 1917     | Sept. 21, 1917    | Aug. 27, 1917           | Dec. 31, 1918              | 5 100                     |
| Fred C. Morgan.                      | Levee work, Riverland levee district, Mo.                               | 95,020                   | 16 cents per cubic yard.    | May 11, 1917      | May 31, 1917      | May 18, 1917            | Dec. 31, 1917              | 6 100                     |
| Hillsboro Dredging Co.               | Levee work, East Side levee and sanitary district, Ill.                 | 115,998                  | 35.25 cents per cubic yard. | Jan. 17, 1917     | Feb. 12, 1917     | Feb. 19, 1917           | do.                        | 7 100                     |
| Roach & Stansell.                    | Levee work, East Cape Girardeau and Clear Creek drainage district, Ill. | 34,824                   | 15.38 cents per cubic yard. | Dec. 29, 1916     | Jan. 25, 1917     | Feb. 2, 1917            | do.                        | 8 100                     |
| La Crosse Dredging Co.               | Levee work, Drury drainage district, Ill.                               | 83,000                   | 18.50 cents per cubic yard. | June 6, 1918      | June 26, 1918     | ( <sup>9</sup> )        | June 30, 1919              |                           |
|                                      | Levee work, Muscatine Island levee district, Iowa.                      | 495,000                  | 15.95 cents per cubic yard. | July 19, 1917     | July 31, 1917     | Sept. 11, 1917          | Dec. 31, 1918              | 21.5                      |
| S. R. H. Robinson & Son.             | do.                                                                     | 197,000                  | 15.75 cents per cubic yard. | May 13, 1918      | June 8, 1918      | ( <sup>9</sup> )        | June 30, 1919              |                           |
| B. G. Armstrong.                     | do.                                                                     | 250,000                  | 15.75 cents per cubic yard. |                   |                   |                         |                            |                           |

<sup>1</sup>Time limit waived.  
<sup>2</sup>Completed Dec. 27, 1917.  
<sup>3</sup>Completed Apr. 29, 1918.  
<sup>4</sup>Completed Mar. 20, 1918.  
<sup>5</sup>Completed Sept. 27, 1917.  
<sup>6</sup>Completed Sept. 29, 1917.  
<sup>7</sup>Completed Sept. 29, 1917.  
<sup>8</sup>Completed Oct. 4, 1917.  
<sup>9</sup>Work not commenced.

*Abstract of contracts in force during fiscal year ending June 30, 1918. Improving Mississippi River, Mississippi River Commission, Secretary's office—Continued.*

| Contractor.                   | Character of work and locality.                                              | Cubic yards in contract. | Price.                      | Date of contract. | Date of approval. | Date of beginning work. | Date of expiration. | Percentage of completion. |
|-------------------------------|------------------------------------------------------------------------------|--------------------------|-----------------------------|-------------------|-------------------|-------------------------|---------------------|---------------------------|
| Cameron, Joyce & Co. ....     | Levee work, Gregory drainage district, Mo. ....                              | 47,317                   | 43 cents per cubic yard.    | Oct. 31, 1917     | Dec. 14, 1917     | Nov. 6, 1917            | Dec. 31, 1918       | 97.6                      |
| S. R. H. Robinson & Son. .... | Levee work, Riverland levee district, Mo. ....                               | 500,000                  | 15 cents per cubic yard.    | Oct. 19, 1917     | Dec. 11, 1917     | Apr. 1, 1918            | .....do.....        | 12.4                      |
| McCann Bros. ....             | Levee work, East Cape Girardeau and Clear Creek drainage district, Ill. .... | 20,000                   | 24 cents per cubic yard.    | Nov. 23, 1917     | Dec. 19, 1917     | May 16, 1918            | .....do.....        | 14.4                      |
| Cameron, Joyce & Co. ....     | do. ....                                                                     | 100,000                  | 29.50 cents per cubic yard. | Apr. 8, 1918      | May 15, 1918      | May 18, 1918            | .....do.....        | 29.4                      |

TABLE No. 1.—Commercial statistics for calendar year 1917.

| Tonnage between—                           | Number of passengers. | Receipts and shipments, in tons. |         |                               |             |                |         |
|--------------------------------------------|-----------------------|----------------------------------|---------|-------------------------------|-------------|----------------|---------|
|                                            |                       | Grain and its products.          | Cotton. | Cotton-seed and its products. | Live stock. | Coal and coke. | Lumber. |
| St. Louis and Cairo <sup>1</sup> .....     | 67,666                | 7,586                            | 907     | 1,415                         | 5,608       | 15,183         | 7,357   |
| Cairo and Memphis <sup>2</sup> .....       | 83,742                | 5,064                            | 6,370   | 4,175                         | 2,439       | 220,811        | 30,410  |
| Memphis and Vicksburg <sup>3</sup> .....   | 41,940                | 9,314                            | 14,661  | 9,827                         | 7,031       | 129,847        | 29,652  |
| Vicksburg and New Orleans <sup>4</sup> ... | 18,036                | 5,247                            | 13,193  | 5,865                         | 2,353       | 269,568        | 40,517  |

| Tonnage between—                           | Logs.   | Receipts and shipments, in tons. |                           |                          |           |                                 |           |
|--------------------------------------------|---------|----------------------------------|---------------------------|--------------------------|-----------|---------------------------------|-----------|
|                                            |         | Iron, steel, and metals.         | Groceries and provisions. | Stone, gravel, and sand. | Oil.      | Unclassified and miscellaneous. | Total.    |
| St. Louis and Cairo <sup>1</sup> .....     | 28,664  | 60,584                           | 6,256                     | 2 127,254                | 8,143     | 95,820                          | 364,777   |
| Cairo and Memphis <sup>2</sup> .....       | 195,152 | 55,052                           | 8,967                     | 70,089                   | 5,305     | 31,610                          | 635,444   |
| Memphis and Vicksburg <sup>3</sup> .....   | 208,821 | 58,803                           | 13,389                    | 932,612                  | 5,745     | 73,838                          | 1,493,540 |
| Vicksburg and New Orleans <sup>4</sup> ... | 238,245 | 1,249                            | 46,237                    | 247,478                  | 1,515,115 | 164,587                         | 2,549,654 |

NOTE.—Each stretch is treated as a separate river, and tonnage carried between ports on different stretches will appear in the statistics of all intervening stretches; consequently the sum of the tonnage carried in the four stretches does not represent the total traffic on the river as a whole.

<sup>1</sup> Includes 14,126 tons coal, 100 tons logs, 150 tons groceries, 38,929 tons stone and gravel, 3,195 tons miscellaneous handled by Government vessels.

<sup>2</sup> Does not include 675,682 tons of sand and gravel barged in vicinity of St. Louis.

<sup>3</sup> Includes 21,451 tons stone and gravel handled by Government vessels.

<sup>4</sup> Includes 217 tons grain and its products, 466 tons live stock, 5,415 tons coal and coke, 716 tons iron and steel, 310 tons groceries and provisions, 94,762 tons stone and gravel, 8 tons oil, and 54,900 tons miscellaneous handled by Government vessels.

<sup>5</sup> Includes 78 tons live stock, 510 tons coal and coke, 30 tons iron and steel, 950 tons stone, gravel, and sand, and 4,300 tons miscellaneous handled by Government vessels.

TABLE No. 2.—Receipts and shipments at principal ports.

| Port.                               | Passengers carried in and out of port. | Receipts and shipments in tons. |         |                               |             |                |         |
|-------------------------------------|----------------------------------------|---------------------------------|---------|-------------------------------|-------------|----------------|---------|
|                                     |                                        | Grain and its products.         | Cotton. | Cotton seed and its products. | Live stock. | Coal and coke. | Lumber. |
| St. Louis, Mo. <sup>1</sup> .....   | 506,782                                | 7,625                           | 907     | 1,415                         | 10,596      | 32,587         | 8,088   |
| Memphis, Tenn. <sup>2</sup> .....   | 137,420                                | 5,919                           | 14,672  | 4,004                         | 3,229       | 141,905        | 1,624   |
| Vicksburg, Miss. <sup>3</sup> ..... | 138                                    | 251                             | 36      | 113                           | 388         | 3,173          | 11,792  |
| New Orleans, La. <sup>4</sup> ..... | 34,225                                 | 1,558,623                       | 259,382 | 24,505                        | 6,748       | 159,584        | 439,765 |

| Port.                               | Receipts and shipments in tons. |                          |                           |                          |           |                                 |           |
|-------------------------------------|---------------------------------|--------------------------|---------------------------|--------------------------|-----------|---------------------------------|-----------|
|                                     | Logs.                           | Iron, steel, and metals. | Groceries and provisions. | Stone, gravel, and sand. | Oil.      | Unclassified and miscellaneous. | Total.    |
| St. Louis, Mo. <sup>1</sup> .....   | 22,100                          | 58,569                   | 11,638                    | 693,066                  | 105       | 128,429                         | 975,125   |
| Memphis, Tenn. <sup>2</sup> .....   | 87,809                          | 2,615                    | 7,999                     | 294,040                  | 523       | 11,593                          | 575,992   |
| Vicksburg, Miss. <sup>3</sup> ..... | 63,771                          | 751                      | 685                       | 12,200                   | 10        | 7,076                           | 100,246   |
| New Orleans, La. <sup>4</sup> ..... | 440,328                         | 924,207                  | 1,494,411                 | 37,423                   | 2,407,754 | 989,573                         | 8,742,303 |

<sup>1</sup> Includes 443,051 passengers in local excursion traffic.

<sup>2</sup> Includes 124,475 passengers in local excursion traffic and 930 tons stone and gravel handled by Government vessels.

<sup>3</sup> Includes 167 tons grain and its products, 388 tons live stock, 763 tons coal and coke, 291 tons lumber, 746 tons iron, 310 tons groceries, 8 tons oil, 7,100 tons stone and gravel, and 5,600 tons miscellaneous handled by Government vessels.

<sup>4</sup> Includes exports, imports, and the domestic coastwise traffic as far as reported; also 8,881 tons coal and coke, 9,181 tons lumber, 600 tons groceries and provisions, 800 tons oil, 77,623 tons stone, gravel and sand, and 64,902 tons miscellaneous handled by Government vessels.

TABLE No. 3.—*Seagoing traffic at New Orleans, La.*

| Arrivals and departures.   | Number. | Tonnage.  | Passengers. |
|----------------------------|---------|-----------|-------------|
| Foreign-bound vessels..... | 1,609   | 3,013,688 | 22,15       |
| Coastwise vessels.....     | 426     | 851,787   | 6,59        |
| Total.....                 | 2,035   | 3,865,475 | 28,74       |

| <i>Receipts and shipments.</i>      |  | Tons.    |
|-------------------------------------|--|----------|
| Grain and its products.....         |  | 1,555,01 |
| Cotton.....                         |  | 252,91   |
| Cotton seed and its products.....   |  | 20,30    |
| Live stock.....                     |  | 4,65     |
| Lumber.....                         |  | 406,24   |
| Logs.....                           |  | 312,92   |
| Iron, steel, and metals.....        |  | 922,42   |
| Groceries and provisions.....       |  | 1,449,50 |
| Oils.....                           |  | 2,340,59 |
| Stone, gravel, and sand.....        |  | 14,70    |
| Miscellaneous and unclassified..... |  | 902,38   |
| Total.....                          |  | 8,181,67 |

TABLE No. 4.—*Ferry traffic.*

| Location of ferries and transfers.                                                                      | Number of passengers. | Tonnage of freight carried. |         |                               |             |                |         |
|---------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------|---------|-------------------------------|-------------|----------------|---------|
|                                                                                                         |                       | Grain and its products.     | Cotton. | Cotton seed and its products. | Live stock. | Coal and coke. | Lumber. |
| At St. Louis, Mo.....                                                                                   | 375,043               | 229,000                     | 600     | 9,125                         | 3,450       | 2,060,000      | 266,00  |
| At Little Rock, Mo., Commerce, Mo., and Cape Girardeau, Mo.....                                         | 36,166                | 765                         |         |                               | 558         | 629,390        | 6       |
| At Cairo, Ill., to Birds Point, Mo., and Wickliffe, Ky., and Richardson, Tenn.....                      | 188,954               | 137                         |         |                               | 720         |                |         |
| At Memphis, Tenn., to Mound City, Ark., and West Memphis, Ark.....                                      | 81,822                | 200                         | 664     | 804                           | 2,984       | 15             | 20      |
| At Helena, Ark., to Trotters Point, Miss.....                                                           | 119,385               | 5,254                       | 1,766   | 4,574                         | 1,009       | 165,168        | 70,60   |
| At Vicksburg, Miss., to Delta Point, La.....                                                            | 155,256               | 16,859                      | 219     | 260                           | 2,236       | 126,914        | 11,30   |
| At Natchez, Miss., Vidalia, La., Baton Rouge, La., Bayou Sara, La., Plaquemine, La., Anchorage, La..... | 220,944               | 180,412                     | 64,048  | 8,592                         | 8,412       | 69,134         | 143,60  |
| At New Orleans, La.....                                                                                 | 5,646,699             | 340,855                     | 101,343 | 22,200                        | 15,594      | 184,928        | 218,70  |

| Location of ferries and transfers.                                                                      | Tonnage of freight carried. |                          |                           |                          |        |                                 |                |
|---------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------|---------------------------|--------------------------|--------|---------------------------------|----------------|
|                                                                                                         | Logs.                       | Iron, steel, and metals. | Groceries and provisions. | Stone, gravel, and sand. | Oil.   | Unclassified and miscellaneous. | Total tonnage. |
| At St. Louis, Mo.....                                                                                   | 8,650                       | 81,000                   | 113,200                   | 76,000                   | 55,500 | 197,172                         | 3,099,60       |
| At Little Rock, Mo., Commerce, Mo., and Cape Girardeau, Mo.....                                         |                             | 38                       | 18                        | 7,953                    |        | 313,014                         | 952,30         |
| At Cairo, Ill., to Birds Point, Mo., and Wickliffe, Ky., and Richardson, Tenn.....                      |                             | 111                      | 197                       |                          |        | 33,561                          | 34,80          |
| At Memphis, Tenn., to Mound City, Ark., and West Memphis, Ark.....                                      |                             | 15                       | 208                       |                          |        | 11,999                          | 17,00          |
| At Helena, Ark., to Trotters Point, Miss.....                                                           | 1,750                       | 506                      | 8,694                     | 6,223                    | 9,228  | 7,299                           | 282,10         |
| At Vicksburg, Miss., to Delta Point, La.....                                                            |                             | 67,778                   | 3,198                     | 4,058                    | 1,377  | 160,403                         | 394,60         |
| At Natchez, Miss., Vidalia, La., Baton Rouge, La., Bayou Sara, La., Plaquemine, La., Anchorage, La..... | 363                         | 52,036                   | 131,619                   | 35,439                   | 87,518 | 206,694                         | 987,90         |
| At New Orleans, La.....                                                                                 |                             | 223,797                  | 7,004                     | 9,963                    | 84,081 | 1,827,610                       | 3,045,10       |

Transfer of empty cars not included in tonnage at railroad transfer points.

Owing to deficiency and inaccessibility of the records of some transportation companies, considerable tonnage, which should appear under classified heads above, had to be included in "Unclassified and miscellaneous."

Statement of maps and charts issued and sold from July 1, 1917, to June 30, 1918, improving Mississippi River, Mississippi River Commission, secretary's office.

| Description.                                                     | Free<br>issue. | Sold. | Total. |
|------------------------------------------------------------------|----------------|-------|--------|
| Charts, Mississippi River, scale 1:20000.....                    | 687            | 334   | 1,021  |
| Charts, Mississippi River, scale 1:10000.....                    | 220            | 36    | 256    |
| Charts, lower Mississippi River, scale 1 inch=1 mile.....        | 89             | 194   | 283    |
| Charts, upper Mississippi River, scale 1 inch=1 mile.....        | 188            | 222   | 410    |
| Charts, upper alluvial valley (4 sheets each).....               | 9              | 14    | 23     |
| Charts, upper alluvial valley.....                               | 1              | 2     | 3      |
| Charts, lower alluvial valley (8 sheets each), 1913 edition..... | 6              | 7     | 13     |
| Charts, lower alluvial valley, 1913 edition.....                 | 2              |       | 2      |
| Charts, lower alluvial valley (8 sheets each), 1887 edition..... | 3              | 21    | 24     |
| Charts, lower alluvial valley, 1887 edition.....                 |                |       |        |
| Charts, harbor New Orleans, scale 1:10000 (4 sheets each).....   | 2              | 7     | 9      |
| Charts, district map of lower Mississippi River.....             | 6              | 9     | 15     |
| Charts, Lake Itasca Basin.....                                   | 2              | 16    | 18     |
| Charts, St. Francis Basin (2 sheets each).....                   | 1              | 2     | 3      |
| Charts, St. Francis Basin.....                                   |                | 2     | 2      |
| Total.....                                                       | 1,216          | 866   | 2,082  |

Proceeds deposited to the credit of the Treasurer of the United States, \$188.51.

TABLE NO. 1.—*Highest and lowest gauge readings of 1917.*  
MISSISSIPPI RIVER.

| Station.                              | Dis-<br>tance<br>from<br>airo.<br>(airo. | Elevation<br>of gauge<br>zero<br>above<br>mean<br>Gulf<br>level. | Highest.               |                        |                 | Lowest.               |                        |              | Difference<br>com-<br>pared<br>with<br>previous<br>lowest. |
|---------------------------------------|------------------------------------------|------------------------------------------------------------------|------------------------|------------------------|-----------------|-----------------------|------------------------|--------------|------------------------------------------------------------|
|                                       |                                          |                                                                  | Prior to 1917.         |                        | 1917            | Prior to 1917.        |                        | 1917         |                                                            |
|                                       |                                          |                                                                  | Date.                  | Gauge<br>read-<br>ing. |                 | Date.                 | Gauge<br>read-<br>ing. |              |                                                            |
|                                       | <i>Miles<br/>above.</i>                  | <i>Feet.</i>                                                     |                        | <i>Feet.</i>           |                 | <i>Feet.</i>          |                        | <i>Feet.</i> | <i>Feet.</i>                                               |
| Aitkin, Minn.....                     | 1,090                                    | 1,186.35                                                         | July 6-8, 1905.....    | 16.36                  | Apr. 22.....    | Apr. 8, 9, 1911.....  | Nov. 27.....           | +1.05        |                                                            |
| St. Paul, Minn.....                   | 874                                      | 684.24                                                           | Apr. 29, 1881.....     | 19.7                   | Apr. 8.....     | Dec. 5, 1912.....     | Dec. 5.....            | 0            |                                                            |
| Hastings, Minn.....                   | 849                                      | 670.36                                                           | Apr. 30, 1881.....     | 18.00                  | Apr. 9.....     | Nov. 23, 1892.....    | Dec. 4, 8.....         | 0            |                                                            |
| Winona, Minn.....                     | 760                                      | 639.90                                                           | June 18, 1880.....     | 16.87                  | Apr. 12.....    | Dec. 30, 1889.....    | Dec. 7-8.....          | +2.53        |                                                            |
| Prairie du Chien, Wis.....            | 668                                      | 605.16                                                           | June 22, 1880.....     | 21.30                  | Apr. 15-16..... | do.....               | Oct. 11.....           | +2.40        |                                                            |
| Rock Island, Ill.....                 | 510.7                                    | 541.94                                                           | June 27, 1892.....     | 19.4                   | Apr. 21.....    | Dec. 5, 1910.....     | Dec. 9.....            | +2.35        |                                                            |
| Burlington, Iowa.....                 | 427.6                                    | 510.82                                                           | (May 18, 19, 1888..... | 17.6                   | June 17.....    | Dec. 10, 1910.....    | Dec. 19.....           | +4.35        |                                                            |
| Fort Madison, Iowa.....               | 406.5                                    | 502.23                                                           | June 30, 1892.....     | 21.40                  | June 17-18..... | 1895.....             | do.....                | +10.9        |                                                            |
| Nashville, Iowa.....                  | 393.6                                    | 496.43                                                           | May 17, 18, 1888.....  | 12.0                   | June 13.....    | Jan. 7, 1890.....     | do.....                | +2.35        |                                                            |
| Keokuk, Iowa.....                     | 385.2                                    | 477.35                                                           | June 6, 1851.....      | 20.96                  | June 9.....     | Jan. 8, 1909.....     | Dec. 20.....           | +1.10        |                                                            |
| Hannibal, Mo.....                     | 329.4                                    | 448.97                                                           | June 8, 1903.....      | 22.5                   | June 14.....    | Dec. 14, 1910.....    | Dec. 10.....           | +2.3         |                                                            |
| Grafton, Ill.....                     | 233                                      | 403.66                                                           | June 11, 1903.....     | 28.7                   | June 14.....    | Dec. 9, 1895.....     | Dec. 13.....           | +80          |                                                            |
| Alton, Ill.....                       | 216.2                                    | 313.54                                                           | June 9, 1903.....      | 7115.80                | do.....         | (Dec. 19, 1897.....   | Dec. 12-13.....        | +58          |                                                            |
| St. Louis, Mo.....                    | 190.8                                    | 379.79                                                           | June 10, 1903.....     | 38.00                  | do.....         | Jan. 2, 1900.....     | Dec. 30.....           | +1.3         |                                                            |
| Chester, Ill.....                     | 115.5                                    | 340.87                                                           | June 13, 1903.....     | 33.4                   | June 15-16..... | Jan. 3, 1900.....     | Dec. 31.....           | +4.00        |                                                            |
| Grand Tower, Ill.....                 | 85                                       | 321.74                                                           | June 14, 1903.....     | 33.80                  | June 16.....    | Feb. 1, 1895.....     | do.....                | +5.00        |                                                            |
| Cape Girardeau, Mo.....               | 54.5                                     | 304.54                                                           | do.....                | 36.53                  | do.....         | Jan. 15, 1909.....    | Dec. 15-16.....        | +1.38        |                                                            |
| Grays Point, Mo.....                  | 48                                       | 300.85                                                           | Feb. 3, 1916.....      | 36.00                  | do.....         | do.....               | do.....                | +1.91        |                                                            |
| Cairo, Ill.....                       | 0                                        | 270.41                                                           | Apr. 7, 1913.....      | 54.69                  | Apr. 4-5.....   | Dec. 24, 1871.....    | Dec. 16-17.....        | +2.15        |                                                            |
| Columbus, Ky.....                     | 21.6                                     | 266.46                                                           | Apr. 8, 1913.....      | 49.30                  | Apr. 5.....     | Nov. 6-8, 1895.....   | Dec. 16.....           | +1.70        |                                                            |
| Morrisson Landing, Mo., <sup>11</sup> | 69                                       | 256.04                                                           | Feb. 24, 1884.....     | 41.50                  | Apr. 5-6.....   | Nov. 11-13, 1879..... | Dec. 16.....           | +1.00        |                                                            |
| New Madrid, Mo.....                   | 70.3                                     | 255.96                                                           | Apr. 9, 1913.....      | 44.61                  | Apr. 7-8.....   | Nov. 6-8, 1895.....   | Dec. 17-18.....        | +4.45        |                                                            |
| Cottonwood Point, Mo.....             | 122.5                                    | 230.50                                                           | Apr. 11, 12, 1913..... | 42.30                  | Apr. 9.....     | Nov. 5-8, 1895.....   | Dec. 17.....           | +1.65        |                                                            |
| Fulton, Tenn.....                     | 175.4                                    | 208.74                                                           | Apr. 9, 1913.....      | 44.07                  | Apr. 10.....    | Nov. 7, 8, 1895.....  | Dec. 17.....           | +2.15        |                                                            |
| Memphis, Tenn.....                    | 230                                      | 184.21                                                           | do.....                | 46.55                  | Apr. 10.....    | Nov. 6-9, 1895.....   | Dec. 18.....           | +90          |                                                            |
| Mhoon Landing, Miss.....              | 276.3                                    | 161.35                                                           | Apr. 10, 1913.....     | 45.28                  | Apr. 10-12..... | Nov. 6-11, 1895.....  | Dec. 19.....           | +1.70        |                                                            |
| Helena, Ark.....                      | 306.5                                    | 141.81                                                           | Apr. 22, 1913.....     | 55.20                  | Apr. 12-13..... | Nov. 8, 9, 1895.....  | Dec. 19-20.....        | +1.30        |                                                            |
| Sunflower Landing, <sup>12</sup>      | 352.7                                    | 127.25                                                           | Feb. 10, 1916.....     | 51.60                  | Apr. 13-14..... | Nov. 12-14, 1895..... | do.....                | +1.00        |                                                            |



TABLE No. 1.—*Highest and lowest gauge readings of 1917*—Continued.  
 TRIBUTARIES OF MISSISSIPPI RIVER AND THE ATCHAFALAYA.

| River.      | Station.                      | Approximate distance of station from—<br>Miles. | Elevation of gauge zero above mean Gulf level. | Highest.                               |                |                    |                | Lowest.                                               |                |                                |                |
|-------------|-------------------------------|-------------------------------------------------|------------------------------------------------|----------------------------------------|----------------|--------------------|----------------|-------------------------------------------------------|----------------|--------------------------------|----------------|
|             |                               |                                                 |                                                | Prior to 1917.                         |                | 1917               |                | Prior to 1917.                                        |                | 1917                           |                |
|             |                               |                                                 |                                                | Date.                                  | Gauge reading. | Date.              | Gauge reading. | Date.                                                 | Gauge reading. | Date.                          | Gauge reading. |
| Arkansas    | Little Rock, Ark.             | 174                                             | 222.06                                         | Feet.                                  | Feet.          | Feet.              | Feet.          | Feet.                                                 | Feet.          | Feet.                          | Feet.          |
| Do          | Pine Bluff, Ark.              | 108                                             | 180.78                                         | May 21, 1892.....                      | 31.20          | June 12.....       | 16.20          | Sept. 9, 1913.....                                    | —              | Nov. 24-25.....                | —              |
|             |                               |                                                 |                                                | May 22, 1892.....                      | 30.50          | June 13.....       | 17.6           | Nov. 20-23, 1887.....                                 | —              | Nov. 16-19, 23-<br>Dec. 2..... | —              |
| Atchafalaya | Barre Landing, La.            | 0                                               | 3.88                                           | May 11-15, 1912.....                   | 53.55          | May 1.....         | 44.95          | Oct. 26, 1897.....                                    | —              | Dec. 2.....                    | —              |
| Do          | Simmesport, La.               | 5                                               | 5.79                                           | May 13, 1912.....                      | 50.14          | Apr. 30-May 3..... | 41.7           | Nov. 8, 1891.....                                     | —              | ( <sup>2</sup> ).....          | —              |
| Do          | Melville, La.                 | 31                                              | .44                                            | Feb. 14, 1916.....                     | 43.0           | Apr. 30-May 2..... | 39.6           | Nov. 12, 13, 1894.....                                | —              | Dec. 28.....                   | —              |
| Cumberland  | Nashville, Tenn.              | 246                                             | 366.17                                         | Jan. 22, 1882.....                     | 55.30          | Mar. 10.....       | 45.70          | Oct. 15, 16, 1878.....                                | —              | July 14.....                   | —              |
|             |                               |                                                 |                                                |                                        |                |                    |                | { Aug. 30, Sept. 1,<br>1873, Aug. 5,<br>12, 1874..... | —              |                                | —              |
| Illinois    | Peoria, Ill.                  | 160                                             | 428.52                                         | Jan. 25, 1916.....                     | 23.1           | June 16.....       | 18.2           | { Aug. 5-9, 1886,<br>Jan. 8, 1890.....                | —              | Oct. 7-9, 15.....              | —              |
| Do          | Beardstown, Ill.              | 86                                              | 419.87                                         | Feb. 25, 1883,<br>Apr. 5, 6, 1913..... | 21.80          | June 17.....       | 19.1           | Sept. 18, 19, 1879.....                               | —              | Oct. 11-17.....                | —              |
| Missouri    | Kansas City, Mo.              | 388                                             | 716.93                                         | June 1, 2, 1903.....                   | 35.0           | June 9.....        | 26.5           | Dec. 5-9, 1886,<br>Jan. 8, 1890.....                  | —              | Dec. 15.....                   | —              |
| Do          | Coles Creek, Mo. <sup>s</sup> | 107                                             | 431.54                                         | May 15, 1892.....                      | 96.76          | June 12.....       | 24.8           | Dec. 24, 1897.....                                    | 70.7           |                                |                |
| Do          | Hermann, Mo.                  | 103                                             | 481.74                                         | June 6, 1903.....                      | 7.23.5         | June 12.....       | 24.8           | Dec. 21, 22, 1878.....                                | —              | Jan. 1, 17-18.....             | —              |
| Do          | St. Charles, Mo.              | 28                                              | 413.53                                         | June 8, 1903.....                      | 8.33.95        | June 13-14.....    | 28.95          | Dec. 26, 1879.....                                    | —              | Feb. 6.....                    | —              |
| Ohio        | Pittsburgh, Pa.               | 966                                             | 697.2                                          | Mar. 15, 1907.....                     | 35.5           | Jan. 23.....       | 25.2           | Sept. 28, 1881.....                                   | —              | Feb. 14-15.....                | —              |
| Do          | Cincinnati, Ohio              | 498                                             | 429.25                                         | Feb. 14, 1884.....                     | 71.06          | Mar. 17.....       | 56.1           | Sept. 18, 1881.....                                   | —              | June 25.....                   | —              |
| Do          | Louisville (upper), Ky.       | 364                                             | 402.53                                         | Feb. 16, 1884.....                     | 46.60          | Mar. 19.....       | 30.5           | Oct. 10, 1886.....                                    | —              | Dec. 22.....                   | —              |
| Do          | Louisville (lower), Ky.       | 364                                             | 375.59                                         | do.....                                | 72.00          | do.....            | 56.1           | do.....                                               | —              | Oct. 12, Dec. 23.....          | —              |
| Do          | Evansville, Ind.              | 179                                             | 329.18                                         | Feb. 19, 1884.....                     | 48.8           | Mar. 22.....       | 42.9           | Nov. 7, 8, 1895.....                                  | —              | Oct. 8.....                    | —              |
| Do          | Paducah, Ky.                  | 43                                              | 286.26                                         | Apr. 1, 1913.....                      | 54.3           | Mar. 25-26.....    | 47.1           | Oct. 30-Nov. 4, 1895.....                             | —              | Oct. 18, 21-22.....            | —              |
| Do          | Cairo, Ill.                   | 0                                               | 270.41                                         | do.....                                | 54.69          | Apr. 4-5.....      | 49.95          | Dec. 24, 1871.....                                    | —              | Dec. 16-17.....                | —              |
| Ouachita    | Mo. Red Riv. .387             | 0                                               | 71.10                                          | May 12, 1882.....                      | 46.0           | Mar. 8.....        | 31.7           | Aug. 29, 30, 1887.....                                | —              | Oct. 22-25.....                | —              |
| Do          | Monroe, La.                   | 217                                             | 30.97                                          | 1874.....                              | 49.1           | Apr. 9.....        | 28.4           | Sept. 13-20, 1909.....                                | —              | Oct. 22-26, Nov. 23-24.....    | —              |

| Red.         | Fulton, Ark.                 | Mouth <sup>10</sup> | 482 | 224.48 | July 17, 1876       | 35.75 | May 1      | 20.12—15.63  | Sept. 20—25, Oct. 20—22, 1896 | Nov. 10—15, 1896 | Nov. 10—15, 1896 |
|--------------|------------------------------|---------------------|-----|--------|---------------------|-------|------------|--------------|-------------------------------|------------------|------------------|
| Do.          | Garland, Ark. <sup>6</sup>   | Mouth               | 424 | 203.16 | Mar. 24, 1894       | 28.50 | May 4      | 10.4—25.50   | Sept. 22—25, 1896             | — .20            | — 6.7—1.20       |
| Do.          | Shreveport, La.              | Mouth               | 306 | 140.99 | August, 1849        | 35.90 | May 4      | 10.4—25.50   | Dec. 2—4, 1894                | — 5.50           | — 6.7—1.20       |
| Do.          | Alexandria, La.              | Mouth               | 118 | 44.18  | July 6, 1908        | 41.84 | May 6      | 18.47—23.37  | Oct. 13, 1916                 | — 3.7            | — .05 + 3.75     |
| St. Francis. | Bridge St. L. I. M.          | Mouth               | 100 | 176.5  | Apr. 4—6, 1897      | 41.6  | Apr. 13—15 | 23.9—17.7    | Sept. 29, 1881                | — .05            | — 1.8 + 1.85     |
| Do.          | & S. R.                      | Mouth               | 86  |        | Apr. 28, 1886       | 42.02 |            |              | Nov. 3—11, 1901               | — 3.60           | —                |
| Tennessee    | Wittsburg, Ark. <sup>6</sup> | Mouth               | 508 | 617.81 | Apr. 28, 1886       | 58.6  | Mar. 7     | 11 47.7—10.9 | Oct. 27—31, Nov. 10—14, 1892  | — .00            | — 11 6.9 + 6.90  |
| Do.          | Chattanooga, Tenn.           | Cairo               | 301 | 400.85 | Mar. 11, 1867       | 32.20 | Mar. 12    | 24.70—7.50   | Sept. 11—14, 1881             | — .76            | — .00 + .76      |
| Do.          | Florence, Ala.               | Cairo               | 141 | 315.89 | Mar. 19, 1897       | 48.0  | Mar. 18    | 38.8—9.2     | Oct. 24, 28, 1872             | — .9             | — 1.5 + 2.4      |
| Do.          | Johnsonville, Tenn.          | Cairo               | 65  | 73.61  | 1882, Mar. 24, 1897 | 36.50 | Apr. 29    | 29.6—6.90    | Sept. 18, 1878                | —                | —                |
| Wabash.      | Mount Carmel, Ill.           | Cairo               | 221 | 372.27 | Mar. 30, 1913       | 31.0  | June 12    | 22.6—8.4     | Oct. 26—Nov. 4, 1904          | — .2             | — 1.0 + 1.2      |
| White.       | Jacksonport, Ark.            | Mouth               | 264 | 138.47 | Aug. 23, 1915       | 33.96 | Apr. 6     | 26.08—7.88   | Nov. 7—23, 1895               | — 1.10           | — 1.0 + 1.20     |
| Do.          | Clarendon, Ark.              | Mouth               | 100 | 138.47 | Feb. 7, 1916        | 38.43 | Apr. 20    | 27.57—10.86  | Dec. 24, 1872                 | — 4.07           | — 5.90 + 1.83    |
| Yazoo.       | Yazoo City, Miss.            | Mouth               | 65  | 73.61  | 1882                | 36.50 | Apr. 29    | 29.6—6.90    | Nov. 22, 1887                 | — 4.30           | — 2.0 + 2.30     |

<sup>1</sup> Record from May, 1892, to December, 1905, in part only.

<sup>2</sup> Readings below 30 feet discontinued Jan. 16, 1915.

<sup>3</sup> Low stage affected by dam.

<sup>4</sup> H. W. of June, 1844, would read 37.0 feet.

<sup>5</sup> Jan. 6, 1874, gauge read —0.1; probably affected by ice.

<sup>6</sup> Discontinued.

<sup>7</sup> H. W. of June, 1844, would read 35.6 feet.

<sup>8</sup> H. W. of June, 1844, would read 38.57 feet.

<sup>9</sup> Stages below 6 feet affected by Davis Island Dam.

<sup>10</sup> Mouth of Red River is assumed to be at junction with Mississippi River.

<sup>11</sup> Stages affected by dam and power plant. See descriptive text.

TABLE No. 2.—*Highest gauge readings, Mississippi River and tributaries, 1918 to June 30.*

[See Table No. 1 for previous highest known readings.]

| River.      | Station.                                             | Date, 1918.           | Gauge reading<br>Fect. |
|-------------|------------------------------------------------------|-----------------------|------------------------|
| Mississippi | St. Paul, Minn.                                      | Mar. 25.              | 7                      |
| Do.         | Rock Island, Ill.                                    | June 13-14.           | 10                     |
| Do.         | Hannibal, Mo.                                        | June 13.              | 17                     |
| Do.         | Grafton, Ill.                                        | June 16-17.           | 17                     |
| Do.         | St. Louis, Mo.                                       | June 12.              | 20                     |
| Do.         | Chester, Ill.                                        | June 13.              | 19                     |
| Do.         | Grand Tower, Ill.                                    | do.                   | 21                     |
| Do.         | Cape Girardeau, Mo.                                  | June 14.              | 23                     |
| Do.         | Cairo, Ill. (Ohio River)                             | Feb. 25.              | 35                     |
| Do.         | Columbus, Ky.                                        | Feb. 25.              | 37                     |
| Do.         | New Madrid, Mo.                                      | Feb. 25-26.           | 31                     |
| Do.         | Cottonwood Point, Mo.                                | Feb. 27.              | 30                     |
| Do.         | Fulton, Tenn.                                        | Feb. 27-Mar. 1.       | 1 <sup>2</sup> 27      |
| Do.         | Memphis, Tenn.                                       | Mar. 1-2.             | 25                     |
| Do.         | Mhoon Landing, Miss.                                 | Mar. 2.               | 33                     |
| Do.         | Helena, Ark.                                         | Mar. 2-3.             | 37                     |
| Do.         | Sunflower Landing, Miss.                             | Mar. 3-5.             | 36                     |
| Do.         | Mouth White River, Ark.                              | Mar. 5.               | 41                     |
| Do.         | Arkansas City, Ark.                                  | Mar. 5-7.             | 35                     |
| Do.         | Greenville, Miss.                                    | Mar. 7.               | 33                     |
| Do.         | Lake Providence, La.                                 | do.                   | 35                     |
| Do.         | Vicksburg, Miss.                                     | Mar. 8.               | 37                     |
| Do.         | St. Joseph, La.                                      | Mar. 8-9.             | 33                     |
| Do.         | Natchez, Miss.                                       | Mar. 8-10.            | 36                     |
| Do.         | Red River Landing, La.                               | May 10.               | 34                     |
| Do.         | Bayou Sara, La.                                      | Mar. 9-12, May 10-12. | 25                     |
| Do.         | Baton Rouge, La.                                     | May 10.               | 26                     |
| Do.         | Plaquemine, La.                                      | May 11.               | 25                     |
| Do.         | Donaldsonville, La.                                  | May 12.               | 20                     |
| Do.         | College Point, La.                                   | do.                   | 17                     |
| Do.         | Carrollton, La.                                      | do.                   | 11                     |
| Do.         | Fort Jackson, La.                                    | May 10-14.            | 2                      |
| Arkansas    | Little Rock, Ark.                                    | May 14.               | 20                     |
| Atchafalaya | Barbre Landing, La.                                  | May 10-11.            | 35                     |
| Do.         | Melville, La.                                        | May 9-12.             | 32                     |
| Cumberland  | Nashville, Tenn.                                     | Feb. 5.               | 45                     |
| Illinois    | Peoria, Ill.                                         | Feb. 20.              | 15                     |
| Missouri    | Kansas City, Mo.                                     | Apr. 2.               | 15                     |
| Do.         | Hermann, Mo.                                         | Apr. 4-5, June 11.    | 15                     |
| Do.         | St. Charles, Mo.                                     | Apr. 6.               | 27                     |
| Ohio        | Pittsburgh, Pa.                                      | Feb. 21.              | 27                     |
| Do.         | Cincinnati, Ohio.                                    | Feb. 2.               | 61                     |
| Do.         | Louisville, Ky. (upper)                              | Feb. 14.              | 26                     |
| Do.         | Louisville, Ky. (lower)                              | do.                   | 51                     |
| Do.         | Evansville, Ind.                                     | Feb. 17.              | 35                     |
| Do.         | Paducah, Ky.                                         | Feb. 25-26.           | 36                     |
| Ouachita    | Camden, Ark.                                         | Apr. 23.              | 35                     |
| Do.         | Monroe, La.                                          | May 8, 10.            | 26                     |
| Red         | Fulton, Ark.                                         | Apr. 21.              | 28                     |
| Do.         | Shreveport, La.                                      | Apr. 25-26.           | 16                     |
| Do.         | Alexandria, La.                                      | Apr. 30.              | 27                     |
| St. Francis | Bridge, St. Louis, Iron Mountain & South-<br>ern Ry. | May 24-26.            | 17                     |
| Tennessee   | Chattanooga, Tenn.                                   | Feb. 2.               | 45                     |
| Do.         | Florence, Ala.                                       | Feb. 6.               | 27                     |
| Do.         | Johnsonville, Tenn.                                  | Feb. 10.              | 30                     |
| Wabash      | Mount Carmel, Ill.                                   | Feb. 21.              | 21                     |
| White       | Jacksonport, Ark.                                    | May 14.               | 32                     |
| Do.         | Clarendon, Ark.                                      | May 27-28.            | 36                     |
| Yazoo       | Yazoo City, Miss.                                    | Apr. 30, May 5-10.    | 14                     |

<sup>1</sup> Stage of 34.1 feet reached Feb. 4, account of ice gorge above going out.

TABLE NO. 3.—Results of discharge observations, Mississippi River,

AT THEBES, ILL. (44.5 MILES ABOVE CAIRO, ILL.).

| Date.            |  | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|------------------|--|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                  |  | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                  |  |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.            |  | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| ne 16.....       |  | 34.2                    | 32.38        | +0.3                      | 110,563                     | 110,563         | 44.6         | 44.6           | 60.7          | 2,479        |
| ne 17.....       |  | 34.1                    | 32.22        | — .1                      | <sup>1</sup> 109,233        |                 |              |                |               |              |
| ne 18, a. m..... |  | 33.6                    | 31.90        | — .5                      | 107,507                     | 108,697         | 43.4         | 43.9           | 58.4          | 2,479        |
| ne 18, p. m..... |  |                         | 31.80        |                           | <sup>1</sup> 107,259        |                 |              |                |               |              |

| Date.            | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.            | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| ne 16.....       |                   | 7.39                               | 816,644                       | 816,644                                          | 2M                                                 | 8            | 32                                           | XI light.                         |                                 |
| ne 17.....       |                   | 7.35                               | 802,496                       | 802,496                                          | 2M                                                 |              |                                              | VI light.                         |                                 |
| ne 18, a. m..... | —1,866            | 7.46                               | 802,284                       | 802,284                                          | 2M                                                 | 11           | 25                                           | VI very light.                    |                                 |
| ne 18, p. m..... |                   | 6.92                               | 742,157                       | 742,157                                          | 2M                                                 |              |                                              | IV brisk.                         |                                 |

<sup>1</sup> Interpolated.

The standard gauge column gives the 8 a. m. readings of the M. R. C. gauge at Cape Girardeau, Mo., the zero of which is 304.54 feet above mean Gulf level.

The zero of the local gauge is 301.18 feet above mean Gulf level.

Datum areas were computed below 32.38 feet on the local gauge.

In the column of method, 2M denotes the mean of simultaneous observations with two meters at six-inches depth.

The discharge section is at street immediately above the Chicago & Eastern Illinois Railroad Depot.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, Secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued

AT COLUMBUS, KY. (21.6 MILES BELOW CAIRO).

| Date.              | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                    | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                    |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width        |
| 1917.              | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Mar. 24.....       | 44.6                    | 44.6         | +0.1                      | 173,702                     | 174,477         | 56.0         | 56.2           | 91.0          | 3.1          |
| Mar. 26.....       | 44.8                    | 44.8         | + .1                      | 171,644                     | 171,861         | 55.3         | 55.4           | 91.0          | 3.1          |
| Mar. 27, a. m..... | 44.8                    | 44.9         | .0                        | 172,993                     | 172,993         | 55.8         | 55.8           | 91.4          | 3.1          |
| Mar. 27, p. m..... | 44.9                    | 44.9         |                           | 172,993                     |                 |              |                |               | 3.1          |
| Mar. 28.....       | 44.7                    | 44.7         | — .1                      | 170,582                     | 171,202         | 55.0         | 55.2           | 96.5          | 3.1          |

| Date.           | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|-----------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.           | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Mar. 24.....    |                   | 7.61                               | 1,321,889                     | 48,607                                           | 1,370,496                                          | M            | 12                                           | 80                                | VI light.                       |
| Mar. 26.....    | -2,616            | 7.99                               | 1,371,788                     | 48,607                                           | 1,420,395                                          | M            | 12                                           | 45                                | VI brisk.                       |
| Mar. 27, a. m.. | +1,132            | 7.80                               | 1,348,619                     | 48,607                                           | 1,397,226                                          | M            | 14                                           | 65                                | IX strong.                      |
| Mar. 27, p. m.. |                   | 7.52                               | 1,301,151                     | 48,607                                           | 1,349,758                                          | 2M           | 14                                           | 65                                | IX brisk.                       |
| Mar. 28.....    | -1,791            | 7.27                               | 1,240,478                     | 48,607                                           | 1,289,085                                          | 2M           | 11                                           | 51                                | VI light<br>brisk.              |

<sup>1</sup> Derived from a. m. soundings.

The standard gauge column gives the 8 a. m. reading of the United States Engineer gauge at Columbus, Ky. The local gauge column gives the reading on the same gauge at the time of making the discharge measurement. The elevation of the gauge zero is 266.46 feet above mean Gulf level.

Datum areas were computed below 44.90 feet on this gauge.

Over-bank discharge deduced from measurements made on Mar. 26 and 27.

In the column of method, M denotes an observation with a single meter; 2M denotes the mean of simultaneous observations with two meters. Price meters Nos. 323 and 324 were used.

Meters were run at six-tenths depth.

The discharge section is that of 1916 and previous years.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE NO. 3.—Results of discharge observations, Mississippi River—Continued.

AT FRIAR POINT, MISS. (318.5 MILES BELOW CAIRO).

| Date.              | Gauges.                 |        |                           | Cross section of discharge. |                 |        |                |               |        |
|--------------------|-------------------------|--------|---------------------------|-----------------------------|-----------------|--------|----------------|---------------|--------|
|                    | Stand-<br>ard<br>gauge. | Local. | Change<br>in 24<br>hours. | Area.                       |                 | Depth. |                |               |        |
|                    |                         |        |                           | Water.                      | Below<br>datum. | Mean.  | Mean<br>datum. | Maxi-<br>mum. | Width. |
| 1917.              | Feet.                   | Feet.  | Feet.                     | Sq. ft.                     | Sq. ft.         | Feet.  | Feet.          | Feet.         | Feet.  |
| Mar. 29.....       | 46.5                    | 4.3    | +0.5                      | 236,921                     | 249,853         | 55.7   | 58.7           | 86.1          | 4,253  |
| Mar. 31.....       | 47.3                    | 4.8    | + .3                      | 246,544                     | .....           | .....  | .....          | .....         | 4,253  |
| Apr. 1.....        | 47.6                    | 5.2    | + .3                      | 248,245                     | 257,093         | 58.4   | 60.4           | 90.6          | 4,253  |
| Apr. 2.....        | 47.9                    | 5.5    | + .3                      | 245,399                     | 253,141         | 57.7   | 59.5           | 88.1          | 4,253  |
| Apr. 3.....        | 48.0                    | 5.6    | + .1                      | 244,111                     | 251,385         | 57.4   | 59.1           | 88.5          | 4,253  |
| Apr. 3, p. m.....  | .....                   | 5.6    | .....                     | 244,111                     | .....           | .....  | .....          | .....         | 4,253  |
| Apr. 5.....        | 48.7                    | 6.0    | + .4                      | 248,283                     | 253,728         | 58.4   | 59.7           | 88.5          | 4,253  |
| Apr. 6.....        | 48.8                    | 6.2    | + .1                      | 245,917                     | 250,554         | 57.8   | 58.9           | 88.9          | 4,253  |
| Apr. 6, p. m.....  | .....                   | 6.3    | .....                     | 245,917                     | .....           | .....  | .....          | .....         | 4,253  |
| Apr. 7.....        | 49.0                    | 6.4    | + .2                      | 247,272                     | 251,271         | 58.1   | 59.1           | 89.1          | 4,253  |
| Apr. 8.....        | 49.3                    | 6.7    | + .3                      | 250,291                     | 252,759         | 58.9   | 59.4           | 89.4          | 4,253  |
| Apr. 9.....        | 49.5                    | 7.0    | + .2                      | 253,311                     | 254,715         | 59.5   | 59.9           | 89.8          | 4,255  |
| Apr. 10.....       | 49.7                    | 7.1    | + .2                      | 250,009                     | 251,030         | 58.8   | 59.0           | 90.7          | 4,255  |
| Apr. 10, p. m..... | .....                   | 7.1    | .....                     | 250,009                     | .....           | .....  | .....          | .....         | 4,255  |
| Apr. 11.....       | 49.8                    | 7.2    | + .1                      | 249,615                     | 250,253         | 58.7   | 58.8           | 88.0          | 4,255  |
| Apr. 12.....       | 49.9                    | 7.2    | + .1                      | 248,382                     | 248,808         | 58.4   | 58.5           | 90.8          | 4,255  |
| Apr. 12, p. m..... | .....                   | 7.2    | .....                     | 248,382                     | .....           | .....  | .....          | .....         | 4,255  |
| Apr. 13.....       | 49.9                    | 7.3    | 0                         | 248,382                     | .....           | .....  | .....          | .....         | 4,255  |
| Apr. 14.....       | 49.8                    | 7.2    | - .1                      | 250,615                     | 251,211         | 58.9   | 59.0           | 87.8          | 4,255  |
| Apr. 14, p. m..... | .....                   | 7.1    | .....                     | 250,615                     | .....           | .....  | .....          | .....         | 4,255  |
| Dec. 25.....       | 2.0                     | .....  | + .4                      | 42,908                      | .....           | 10.7   | .....          | 39.0          | 4,007  |

| Date.              | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Method. | Number<br>of velocity<br>sta-<br>tions. | Number<br>of sound-<br>ings. | Direction and<br>force of wind. |
|--------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|---------|-----------------------------------------|------------------------------|---------------------------------|
| 1917.              | Sq. ft.           | Feet.                              | Cu. ft.                       | Cu. ft.                                          | Cu. ft.                                            |         |                                         |                              |                                 |
| Mar. 29.....       | .....             | 5.47                               | 1,295,403                     | 959                                              | 1,296,362                                          | 2M      | 17                                      | 110                          | V light.                        |
| Mar. 31.....       | .....             | 5.59                               | 1,378,567                     | 959                                              | 1,379,526                                          | F       | 18                                      | .....                        | III light to V<br>strong.       |
| Apr. 1.....        | +7,240            | 5.60                               | 1,390,109                     | 959                                              | 1,391,068                                          | 2M      | 18                                      | 90                           | Calm to IV<br>light.            |
| Apr. 2.....        | -3,952            | 5.59                               | 1,372,922                     | <sup>3</sup> 959                                 | 1,373,881                                          | M       | 18                                      | 104                          | V light.                        |
| Apr. 3.....        | -1,756            | 5.43                               | 1,324,881                     | 913                                              | 1,325,794                                          | M       | 17                                      | 103                          | II light.                       |
| Apr. 3, p. m.....  | .....             | 5.81                               | 1,417,991                     | 913                                              | 1,418,904                                          | F       | 20                                      | .....                        | Do.                             |
| Apr. 5.....        | +2,343            | 5.64                               | 1,399,146                     | 821                                              | 1,399,967                                          | 2M      | 17                                      | 103                          | IX strong.                      |
| Apr. 6.....        | -3,174            | 5.64                               | 1,386,966                     | <sup>3</sup> 775                                 | 1,387,741                                          | 2M      | 19                                      | 90                           | Calm.                           |
| Apr. 6, p. m.....  | .....             | 5.90                               | 1,449,814                     | 775                                              | 1,450,589                                          | F       | 22                                      | .....                        | Do.                             |
| Apr. 7.....        | + 717             | 5.72                               | 1,415,351                     | 898                                              | 1,416,249                                          | M       | 18                                      | 108                          | III light to<br>brisk.          |
| Apr. 8.....        | +1,448            | 5.72                               | 1,431,455                     | 1,021                                            | 1,432,476                                          | M       | 18                                      | 101                          | VIII strong.                    |
| Apr. 9.....        | +1,956            | 5.80                               | 1,469,042                     | 1,144                                            | 1,470,186                                          | 2M      | 18                                      | 94                           | X light.                        |
| Apr. 10.....       | -3,685            | 5.64                               | 1,409,268                     | 1,267                                            | 1,410,535                                          | 2M      | 18                                      | 90                           | IV light.                       |
| Apr. 10, p. m..... | .....             | 6.04                               | 1,509,050                     | 1,267                                            | 1,510,317                                          | F       | 20                                      | .....                        | Calm.                           |
| Apr. 11.....       | - 777             | 5.82                               | 1,453,809                     | <sup>3</sup> 1,390                               | 1,455,199                                          | 2M      | 18                                      | 97                           | Calm to III<br>light.           |
| Apr. 12.....       | -1,445            | 5.88                               | 1,459,385                     | 1,390                                            | 1,460,775                                          | M       | 18                                      | 85                           | VI light.                       |
| Apr. 12, p. m..... | .....             | 5.98                               | 1,484,638                     | 1,390                                            | 1,486,028                                          | F       | 20                                      | .....                        | V light.                        |
| Apr. 13.....       | .....             | 5.93                               | 1,472,389                     | 1,390                                            | 1,473,779                                          | M       | 20                                      | .....                        | XI strong.                      |
| Apr. 14.....       | +2,403            | 5.57                               | 1,396,162                     | 1,390                                            | 1,397,552                                          | 2M      | 16                                      | 93                           | VII light.                      |
| Apr. 14, p. m..... | .....             | 6.00                               | 1,502,705                     | 1,390                                            | 1,504,095                                          | F       | 19                                      | .....                        | II light.                       |
| Dec. 25.....       | .....             | 3.34                               | 143,327                       | .....                                            | 143,327                                            | 2M      | 17                                      | 44                           | II strong to X<br>light.        |

<sup>1</sup> Derived from soundings of observation immediately preceding, corrected for change in stage.<sup>2</sup> Derived from soundings of Apr. 12, a. m.<sup>3</sup> Observed. Overbank discharge of all other days deduced from these observations.

The readings tabulated in the standard gauge column are the 8 a. m. readings on the United States Engineer gauge at Helena, Ark., the elevation of the zero of this gauge is 141.81 feet above mean Gulf level. The readings in the local gauge column were taken on a gauge near the discharge section at the time of discharge observations. The discharge section was the one used in 1916.

Datum areas were computed below 7.30 feet on the local gauge.

In the column of method, M denotes meter; 2M the mean of simultaneous observations with 2 meters; and F, double floats. Meters were run at six-tenths depth and the lower float at mid-depth. Meters used were Price No. 244 and Price No. 324, and Haskell No. 105, wheel 1/x.

Observations of high-water discharge made under direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary Mississippi River Commission.

Observations of low-water discharge and reduction of high and low measurements under direction of E. J. Thomas, assistant engineer, Secretary Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued.

AT CHICOT CITY, ARK. (433 MILES BELOW CAIRO.)

| Date.              | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                    | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                    |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.              | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 3.....        | 48.9                    | 49.00        | +0.3                      | 213,230                     | 224,714         | 59.2         | 62.4           | 74.0          | 3,600        |
| Apr. 5.....        | 49.7                    | 49.70        | + .5                      | 216,744                     | 225,708         | 60.2         | 62.7           | 73.3          | 3,600        |
| Apr. 6.....        | 50.0                    | 50.10        | + .3                      | 220,590                     | 228,114         | 61.3         | 63.4           | 75.3          | 3,600        |
| Apr. 7.....        | 50.3                    | 50.30        | + .3                      | 221,310                     | .....           | .....        | .....          | .....         | 3,600        |
| Apr. 9.....        | 50.9                    | 51.02        | + .3                      | 224,405                     | 228,617         | 62.3         | 63.5           | 77.2          | 3,600        |
| Apr. 10.....       | 51.2                    | 51.20        | + .3                      | 225,155                     | 228,719         | 62.5         | 63.5           | 76.2          | 3,600        |
| Apr. 11.....       | 51.3                    | 51.41        | + .1                      | 228,570                     | 231,378         | 63.5         | 64.3           | 82.8          | 3,600        |
| Apr. 12.....       | 51.5                    | 51.60        | + .2                      | 226,935                     | 229,059         | 63.0         | 63.6           | 77.3          | 3,600        |
| Apr. 12, p. m..... | .....                   | 51.65        | .....                     | 227,115                     | .....           | .....        | .....          | .....         | 3,600        |
| Apr. 13.....       | 51.8                    | 51.92        | + .3                      | 224,070                     | 225,042         | 62.2         | 62.5           | 79.2          | 3,600        |
| Apr. 14.....       | 51.9                    | 52.00        | + .1                      | 229,630                     | 230,314         | 63.8         | 64.0           | 77.5          | 3,600        |
| Apr. 14, p. m..... | .....                   | 52.02        | .....                     | 229,702                     | .....           | .....        | .....          | .....         | 3,600        |
| Apr. 15.....       | 52.0                    | 52.10        | + .1                      | 231,775                     | 232,099         | 64.4         | 64.5           | 79.3          | 3,600        |
| Apr. 16.....       | 52.0                    | 52.16        | + .0                      | 226,605                     | 226,713         | 62.9         | 63.0           | 78.2          | 3,600        |
| Apr. 17.....       | 52.1                    | 52.19        | + .1                      | 235,580                     | 235,580         | 65.4         | 65.4           | 84.2          | 3,600        |
| Apr. 18.....       | 52.1                    | 52.18        | + .0                      | 230,030                     | 230,066         | 63.9         | 63.9           | 77.5          | 3,600        |
| Apr. 18, p. m..... | .....                   | 52.16        | .....                     | 229,958                     | .....           | .....        | .....          | .....         | 3,600        |

| Date.              | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.              | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Apr. 3.....        | .....             | 6.26                               | 1,335,512                     | 10,500                                           | 1,346,012                                          | 2M           | 14                                           | 76                                | Calm.                           |
| Apr. 5.....        | + 994             | 6.41                               | 1,389,018                     | 12,300                                           | 1,401,318                                          | M            | 13                                           | 66                                | XII strong.                     |
| Apr. 6.....        | +2,406            | 6.36                               | 1,403,486                     | 13,400                                           | 1,416,886                                          | F            | 14                                           | 80                                | Calm.                           |
| Apr. 7.....        | .....             | 6.39                               | 1,413,066                     | 13,900                                           | 1,426,966                                          | 2M           | 12                                           | .....                             | VII brisk.                      |
| Apr. 9.....        | + 503             | 6.38                               | 1,430,815                     | 15,700                                           | 1,446,515                                          | M            | 14                                           | 101                               | II light.                       |
| Apr. 10.....       | + 102             | 6.58                               | 1,481,788                     | 16,200                                           | 1,497,988                                          | 2M           | 14                                           | 84                                | VII light.                      |
| Apr. 11.....       | +2,659            | 6.61                               | 1,510,157                     | 16,800                                           | 1,526,957                                          | M            | 14                                           | 82                                | Calm.                           |
| Apr. 12.....       | -2,319            | 6.53                               | 1,482,458                     | 17,300                                           | 1,499,758                                          | 2M           | 14                                           | 77                                | IX light.                       |
| Apr. 12, p. m..... | .....             | 6.49                               | 1,473,480                     | 17,400                                           | 1,490,880                                          | 2M           | 13                                           | .....                             | Do.                             |
| Apr. 13.....       | -4,017            | 6.69                               | 1,499,867                     | 18,100                                           | 1,517,967                                          | M            | 14                                           | 62                                | II strong.                      |
| Apr. 14.....       | +5,272            | 6.56                               | 1,507,312                     | 18,400                                           | 1,525,712                                          | 2M           | 14                                           | 76                                | II light.                       |
| Apr. 14, p. m..... | .....             | 6.75                               | 1,550,965                     | 18,400                                           | 1,569,365                                          | F            | 18                                           | .....                             | Calm.                           |
| Apr. 15.....       | +1,785            | 6.61                               | 1,531,942                     | 18,600                                           | 1,550,542                                          | M            | 13                                           | 68                                | Do.                             |
| Apr. 16.....       | -5,386            | 6.63                               | 1,502,970                     | 18,700                                           | 1,521,670                                          | 2M           | 13                                           | 82                                | VI light.                       |
| Apr. 17.....       | +8,867            | 6.68                               | 1,572,639                     | 18,800                                           | 1,591,439                                          | M            | 13                                           | 67                                | Calm.                           |
| Apr. 18.....       | -5,514            | 6.59                               | 1,515,634                     | 18,700                                           | 1,534,334                                          | 2M           | 14                                           | 88                                | VII light.                      |
| Apr. 18, p. m..... | .....             | 6.69                               | 1,538,195                     | 18,700                                           | 1,556,895                                          | M            | 12                                           | .....                             | VIII brisk.                     |

<sup>1</sup> Derived from previous day's soundings, corrected for stage.<sup>2</sup> Derived from forenoon soundings, corrected for stage.

The discharge section was the same as that used from Feb. 8 to 14, 1916.

The 8 a. m. readings on the M. R. C. gauge at Arkansas City are tabulated in the standard gauge column. Elevation of zero of gauge is 96.75 feet above mean Gulf level. The readings in the local gauge column are from a gauge at the discharge section, read at the time the measurements were made.

Datum areas were computed below 52.19 feet on the local gauge.

Over-bank measurement was made on left bank on Apr. 5 and 16, and at gap in old levee on Apr. 10 and 17. The items in the column headed "Discharge over bank per second" were deduced from these measurements.

In the column of "Method," M denotes one meter, 2M denotes the mean of simultaneous observations by two meters, and F denotes an observation by double floats, lower float being run at mid-depth. Meter were run at various depths and recorded velocities reduced to six-tenths depth velocities later.

Price meter No. 323 and Haskell meter No. 105, wheel 1 were used.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary Mississippi River Commission.

Reductions made under the direction of E. J. Thomas, assistant engineer, secretary Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued.

AT ARKANSAS CITY, ARK. (438.3 MILES BELOW CAIRO.)

| Date.          | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|----------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.          | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Dec. 24.       | 2.9                     | .....        | +0.7                      | 82,197                      | 84,213          | 36.7         | 37.6           | 63.3          | 2,240        |
| Dec. 26, a. m. | 3.7                     | .....        | + .4                      | 82,998                      | 83,222          | 37.1         | 37.2           | 63.3          | 2,240        |
| Dec. 26, p. m. | 3.8                     | .....        | .....                     | 183,222                     | .....           | .....        | .....          | .....         | 2,240        |

| Date.          | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|----------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.          | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Dec. 24.       | .....             | 1.68                               | 137,687                       | .....                                            | 137,687                                            | F            | 9                                            | 40                                | V Brisk.                        |
| Dec. 26, a. m. | -991              | 1.81                               | 150,351                       | .....                                            | 150,351                                            | F            | 12                                           | 46                                | XI Light.                       |
| Dec. 26, p. m. | .....             | 1.83                               | 152,515                       | .....                                            | 152,515                                            | F            | 10                                           | .....                             | Calm.                           |

<sup>1</sup> Area of Dec. 26, a. m., corrected for stage.

The discharge section was located at extreme lower end of Arkansas City, Ark., about 400 feet below mill.

Readings in the standard gauge column are from the M. R. C. gauge at Arkansas City and indicate the mean stage of the river during the observations. Zero of gauge is 96.75 feet above mean Gulf level.

Datum areas were computed below 3.8 feet on the standard gauge.

Under "Method," F denotes double floats, lower float at mid-depth.

Observations and reduction made under the direction of E. J. Thomas, assistant engineer, secretary Mississippi River Commission.

TABLE NO. 3.—*Results of discharge observations, Mississippi River—Continued*  
AT VICKSBURG, MISS. (599 MILES BELOW CAIRO).

| Date.        | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width        |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 17..... | 49.5                    | 1.5          | +0.2                      | 249,198                     | 250,734         | 71.4         | 71.8           | 111.3         | 3,4          |
| Apr. 18..... | 49.6                    | 1.6          | + .1                      | 255,694                     | 256,985         | 73.3         | 73.7           | 115.8         | 3,4          |
| Apr. 19..... | 49.7                    | 1.7          | + .1                      | 255,928                     |                 |              |                |               | 3,4          |
| Apr. 20..... | 49.8                    | 1.8          | + .1                      | 256,167                     | 256,691         | 73.4         | 73.6           | 113.5         | 3,4          |
| Apr. 21..... | 49.9                    | 2.0          | + .1                      | 256,131                     | 256,166         | 73.4         | 73.4           | 114.3         | 3,4          |
| Apr. 23..... | 50.0                    | 2.0          | + .1                      | 256,316                     | 256,316         | 73.4         | 73.4           | 114.7         | 3,4          |
| Apr. 24..... | 49.9                    | 1.9          | - .1                      | 255,725                     |                 |              |                |               |              |
| Apr. 25..... | 49.8                    | 1.8          | - .1                      | 254,887                     | 255,410         | 73.0         | 73.2           | 112.7         | 3,4          |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per sec-<br>ond. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Number<br>of velocity<br>sta-<br>tions. | Number<br>of sound-<br>ings. | Direction and<br>force of wind |
|--------------|-------------------|--------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|-----------------------------------------|------------------------------|--------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                         | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                         |                              |                                |
| Apr. 17..... |                   | 5.03                                 | 1,253,368                     | 185,700                                          | 1,439,068                                          | 2M           | 15                                      | 74                           | Calm.                          |
| Apr. 18..... | +6,251            | 5.13                                 | 1,312,927                     | 185,700                                          | 1,498,627                                          | M            | 15                                      | 103                          | IX light.                      |
| Apr. 19..... |                   | 5.08                                 | 1,299,534                     | 194,700                                          | 1,494,234                                          | M            | 14                                      |                              | IX brisk.                      |
| Apr. 20..... | - 294             | 5.21                                 | 1,336,736                     | 204,700                                          | 1,541,436                                          | 2M           | 14                                      | 90                           | VIII light.                    |
| Apr. 21..... | - 525             | 5.19                                 | 1,329,048                     | 192,900                                          | 1,521,948                                          | 2M           | 14                                      | 92                           | Calm.                          |
| Apr. 23..... | + 150             | 4.95                                 | 1,268,391                     | 190,400                                          | 1,458,791                                          | F            | 17                                      | 93                           | Do.                            |
| Apr. 24..... |                   | 5.26                                 | 1,345,281                     | 190,400                                          | 1,535,681                                          | M            | 14                                      |                              | Do.                            |
| Apr. 25..... | - 906             | 5.07                                 | 1,291,048                     | 190,400                                          | 1,481,448                                          | M            | 15                                      | 110                          | Do.                            |

<sup>1</sup> Derived from previous day's soundings, corrected for stage.

The readings tabulated in the standard gauge column are the 8 a. m. readings on the United States Engineer gauge at Vicksburg, Miss. Elevation of gauge zero is 46.16 feet above mean Gulf level. The local gauge readings were taken on a gauge at the discharge section at the time of the discharge observations.

The change in 24 hours was taken from the standard gauge.

Datum areas were computed below 50 feet on the standard gauge.

Over-bank discharge includes the Yazoo Canal.

In the column of "Method," M denotes an observation with a single meter, 2M denotes the mean simultaneous measurements with 2 meters, and F denotes double floats. Meters were run at six-tenths depth and the lower float at mid-depth. Price meters Nos. 244 and 324 were used.

The discharge section was at the same location as that used in 1916.

Observations were made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued.

AT RED RIVER LANDING, LA. (765.3 MILES BELOW CAIRO).

| Date.        | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917         | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 13..... | 45.00                   | 45.00        | +0.3                      | 226,207                     | 237,317         | 50.5         | 53.0           | 79.0          | 4,480        |
| Apr. 16..... | 45.90                   | 45.95        | + .3                      | 229,323                     | 236,177         | 51.2         | 52.7           | 77.9          | 4,480        |
| Apr. 18..... | 46.45                   | 46.50        | + .2                      | 228,968                     | 233,358         | 51.1         | 52.1           | 78.9          | 4,480        |
| Apr. 20..... | 46.80                   | 46.80        | + .2                      | 234,924                     | 237,970         | 52.4         | 53.1           | 79.4          | 4,480        |
| Apr. 22..... | 47.30                   | 47.32        | + .2                      | 241,859                     | 242,576         | 54.0         | 54.2           | 81.2          | 4,480        |
| Apr. 24..... | 47.50                   | 47.48        | + .1                      | 241,279                     | 241,279         | 53.9         | 53.9           | 82.0          | 4,480        |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per sec-<br>ond. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|--------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917         | <i>Sq. ft.</i>    | <i>Feet.</i>                         | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Apr. 13..... |                   | 4.98                                 | 1,126,686                     | 1,719                                            | 1,128,405                                          | 2M           | 11                                           | 58                                | X light.                        |
| Apr. 16..... | -1,140            | 4.95                                 | 1,135,336                     | 1,719                                            | 1,137,055                                          | 2M           | 11                                           | 56                                | Calm.                           |
| Apr. 18..... | -2,819            | 4.95                                 | 1,133,731                     | 1,719                                            | 1,135,450                                          | 2M           | 11                                           | 59                                | Do.                             |
| Apr. 20..... | +4,612            | 4.92                                 | 1,154,986                     | 1,719                                            | 1,156,705                                          | 2M           | 11                                           | 52                                | Do.                             |
| Apr. 22..... | +4,606            | 4.92                                 | 1,189,119                     | 1,719                                            | 1,190,838                                          | 2M           | 11                                           | 48                                | Do.                             |
| Apr. 24..... | -1,297            | 5.04                                 | 1,216,340                     | 1,719                                            | 1,218,059                                          | 2M           | 11                                           | 42                                | Do.                             |

<sup>1</sup> Measured.

The discharge section was the same as used in 1913 and previous years.

Datum areas were computed below 47.48 feet on the local gauge.

The gauge readings tabulated are from the United States Engineer gauge at Red River Landing. The a. m. readings are given in the standard gauge column and the readings at the time of making the discharge measurements are given in the local gauge column. Elevation of zero of gauge is 3.57 feet above mean Gulf level.

In the column of method, 2M denotes the mean of simultaneous observations with two meters run at six-tenths depth.

Price meters Nos. 309 and 310 were used.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued.

AT CARROLLTON, LA. (957 MILES BELOW CAIRO.)

| Date.              | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                    | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                    |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.              | <i>Fect.</i>            | <i>Fect.</i> | <i>Fect.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Fect.</i> | <i>Fect.</i>   | <i>Fect.</i>  | <i>Fect.</i> |
| Apr. 24.....       | 16.5                    | 16.72        | -0.1                      | 183,764                     | 184,176         | 84.8         | 85.0           | 109.6         | 2,168        |
| Apr. 25.....       | 16.5                    | 16.63        | .0                        | 182,827                     | 183,584         | 84.4         | 84.7           | 110.0         | 2,168        |
| Apr. 26.....       | 16.5                    | 16.60        | .0                        | 183,838                     | 184,507         | 84.8         | 85.1           | 110.0         | 2,168        |
| Apr. 27, a. m..... | 16.6                    | 16.66        | + .1                      | 179,731                     | 180,273         | 82.9         | 83.2           | 111.0         | 2,168        |
| Apr. 27 p. m.....  |                         | 16.78        |                           | 179,991                     |                 |              |                |               | 2,168        |
| Apr. 28.....       | 16.6                    | 16.70        | .0                        | 180,342                     | 180,797         | 83.2         | 83.4           | 109.0         | 2,168        |
| Apr. 29.....       | 16.7                    | 16.77        | + .1                      | 180,004                     |                 |              |                |               | 2,168        |
| Apr. 30.....       | 16.8                    | 16.78        | + .1                      | 179,672                     | 179,954         | 82.0         | 83.0           | 110.2         | 2,168        |
| May 1, a. m.....   | 16.8                    | 16.86        | .0                        | 179,462                     | 179,570         | 82.8         | 82.8           | 111.0         | 2,168        |
| May 1, p. m.....   |                         | 16.88        |                           | 179,462                     |                 |              |                |               | 2,168        |
| May 2, a. m.....   | 16.8                    | 16.87        | .0                        | 180,765                     | 180,852         | 83.4         | 83.4           | 111.3         | 2,168        |
| May 2, p. m.....   |                         | 16.91        |                           | 180,765                     |                 |              |                |               | 2,168        |
| May 3.....         | 16.8                    | 16.81        | .0                        | 179,070                     | 179,287         | 82.6         | 82.7           | 111.1         | 2,168        |
| May 4.....         | 16.7                    | 16.79        | - .1                      | 178,692                     | 178,952         | 82.4         | 82.5           | 109.5         | 2,168        |

| Date.              | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.              | <i>Sq. ft.</i>    | <i>Fect.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Apr. 24.....       | —                 | 6.15                               | 1,129,714                     | 700                                              | 1,130,414                                          | 2M           | 11                                           | 88                                | VII light.                      |
| Apr. 25.....       | — 592             | 6.49                               | 1,187,780                     | 2 700                                            | 1,188,480                                          | M            | 11                                           | 86                                | Calm.                           |
| Apr. 26.....       | + 923             | 6.23                               | 1,144,416                     | 700                                              | 1,145,116                                          | 2M           | 11                                           | 85                                | XII light.                      |
| Apr. 27, a. m..... | -4,234            | 6.60                               | 1,185,417                     | 700                                              | 1,186,117                                          | M            | 11                                           | 86                                | VI light.                       |
| Apr. 27, p. m..... |                   | 6.17                               | 1,109,851                     | 700                                              | 1,110,551                                          | 2M           | 11                                           |                                   | V brisk.                        |
| Apr. 28.....       | + 524             | 6.48                               | 1,169,377                     | 700                                              | 1,170,077                                          | M            | 11                                           | 70                                | VI strong.                      |
| Apr. 29.....       |                   | 5.98                               | 1,075,908                     | 700                                              | 1,076,608                                          | F            | 14                                           |                                   | Calm.                           |
| Apr. 30.....       | — 843             | 6.38                               | 1,146,292                     | 700                                              | 1,146,992                                          | 2M           | 11                                           | 60                                | VI light.                       |
| May 1, a. m.....   | — 384             | 6.54                               | 1,174,138                     | 700                                              | 1,174,838                                          | M            | 11                                           | 71                                | Strong.                         |
| May 1, p. m.....   |                   | 6.36                               | 1,142,165                     | 700                                              | 1,142,865                                          | M            | 11                                           |                                   | XII light.                      |
| May 2, a. m.....   | +1,282            | 6.30                               | 1,138,210                     | 700                                              | 1,138,910                                          | 2M           | 10                                           | 63                                | III light.                      |
| May 2, p. m.....   |                   | 6.27                               | 1,133,921                     | 700                                              | 1,134,621                                          | 2M           | 11                                           |                                   | IV light.                       |
| May 3.....         | -1,565            | 6.35                               | 1,136,318                     | 700                                              | 1,137,018                                          | M            | 11                                           | 76                                | VI light.                       |
| May 4.....         | — 335             | 6.43                               | 1,148,157                     | 700                                              | 1,148,857                                          | M            | 11                                           | 65                                | Calm.                           |

<sup>1</sup> Interpolated.<sup>2</sup> Measured, other dates assumed to be the same.

The 8 a. m. readings on the United States Engineer gauge at Carrollton are tabulated in the standard gauge column. The readings on the same gauge at the time of discharge measurements are given in the local gauge column. The elevation of the zero of the gauge is 0.13 feet below mean Gulf level.

Datum areas were computed below 16.91 feet on the gauge.

In the column of method M denotes one meter; 2M the mean of simultaneous observations by two meter and F denotes double floats. Meters were run at six-tenths depth; lower float at mid-depth. Price meter No. 323 and Haskell meter No. 105, wheel 1, were used.

The discharge section was the same as that used in 1916 and previous years.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Mississippi River—Continued.

AT CARROLLTON, LA. (957 MILES BELOW CAIRO).

| Date.              | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                    | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                    |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1918.              | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Jan. 25.....       | -0.60                   | -0.20        | -0.20                     | 147,207                     | 149,846         | 72.5         | 73.8           | 96.0          | 2,030        |
| Jan. 26.....       | .31                     | .10          | + .91                     | 147,718                     | 149,748         | 72.8         | 73.8           | 92.6          | 2,030        |
| Jan. 27.....       | .50                     | .48          | + .19                     | 148,079                     | 149,338         | 72.9         | 73.5           | 95.6          | 2,030        |
| Jan. 28.....       | .90                     | .85          | + .40                     | 147,313                     |                 |              |                |               | 2,030        |
| Jan. 29, a. m..... | 1.00                    | .95          | + .10                     | 147,313                     | 147,617         | 72.6         | 72.8           | 95.0          | 2,030        |
| Jan. 29, p. m..... |                         | .90          |                           | 147,313                     |                 |              |                |               | 2,030        |
| Jan. 30.....       | 1.00                    | 1.10         | .00                       | 147,169                     | 147,169         | 72.5         | 72.5           | 95.4          | 2,030        |

| Date.              | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1918.              | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Jan. 25.....       | —                 | 1.20                               | 177,240                       | .....                                            | 177,240                                            | 2M           | 9                                            | 33                                | Calm.                           |
| Jan. 26.....       | — 98              | 1.67                               | 246,056                       | .....                                            | 246,056                                            | 2M           | 9                                            | 24                                | VI strong.                      |
| Jan. 27.....       | — 410             | 1.66                               | 245,932                       | .....                                            | 245,932                                            | 2M           | 9                                            | 44                                | Calm, VI strong.                |
| Jan. 28.....       |                   | 1.89                               | 278,270                       | .....                                            | 278,270                                            | 2M           | 8                                            | .....                             | VI strong.                      |
| Jan. 29, a. m..... | —1,721            | 1.71                               | 251,192                       | .....                                            | 251,192                                            | 2M           | 9                                            | 38                                | I brisk.                        |
| Jan. 29, p. m..... |                   | 1.56                               | 229,289                       | .....                                            | 229,289                                            | F            | 8                                            | .....                             | II brisk.                       |
| Jan. 30.....       | — 448             | 2.06                               | 303,680                       | .....                                            | 303,680                                            | F            | 9                                            | 38                                | XII brisk.                      |

<sup>1</sup> Area of Jan. 29, a. m.

The 8 a. m. readings on the United States Engineer gauge at Carrollton are tabulated in the standard gauge column. The readings on the same gauge at the time of discharge measurements are given in the local gauge column. The elevation of the zero of the gauge is 0.13 foot below mean Gulf level.

Datum areas were computed below 1.10 feet on the gauge.

In the column of method 2M denotes the mean of simultaneous observations with two meters run at six-tenths depth, and F denotes double floats, lower float at mid depth. Price meters Nos. 243 and 309 were used.

The discharge section was the same as that used in 1917 and previous years.

Observations and reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—*Results of discharge observations, Missouri River, at St. Charles, Mo.*

| Date.        | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width        |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| June 14..... | 28.48                   | .....        | 0.0                       | 42,340                      | .....           | 25.7         | .....          | 48.0          | 1,64         |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| June 14..... | .....             | 9.95                               | 421,345                       | .....                                            | 421,345                                            | M            | 11                                           | 16                                |                                 |

<sup>1</sup> Reading on United States Engineer gauge at St. Charles, Mo., at mean time of discharge measurement. The zero of the gauge is 413.53 feet above mean Gulf level.

Price meter No. 309 was used. It was run at six-tenths depth. Measurement was taken from Wabas Railroad bridge at St. Charles, Mo.

Observation made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Cumberland River, at Nashville, Tenn. (190.5 miles above mouth).

| Date.              | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                    | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                    |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.              | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| ar. 9, a. m. ....  | 45.60                   | 45.72        | +0.7                      | 22,844                      | 22,859          | 46.2         | 46.2           | 56.8          | 494          |
| ar. 9, p. m. ....  |                         | 45.75        |                           | <sup>1</sup> 22,859         |                 |              |                |               | 494          |
| ar. 10, a. m. .... | 45.70                   | 45.63        | + .1                      | 22,719                      | 22,778          | 46.0         | 46.1           | 56.8          | 494          |
| ar. 10, p. m. .... |                         | 45.55        |                           | 22,705                      | 22,804          | 46.0         | 46.2           | 56.8          | 494          |
| ar. 11, .....      | 45.20                   | 45.17        | — .5                      | 21,790                      | 22,077          | 44.2         | 44.8           | 57.0          | 494          |
| ar. 12, a. m. .... | 43.90                   | 43.80        | —1.3                      | 21,378                      | 22,337          | 43.6         | 45.6           | 56.0          | 490          |
| ar. 12, a. m. .... |                         | 43.73        |                           | <sup>1</sup> 21,325         |                 |              |                |               | 490          |
| ar. 12, p. m. .... |                         | 43.35        |                           | 21,072                      | 22,253          | 43.0         | 45.4           | 56.0          | 490          |
| ar. 13, .....      | 40.90                   | 40.60        | —3.0                      | 20,062                      | 22,596          | 40.9         | 46.0           | 52.0          | 490          |

| Date.              | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Method. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|---------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.              | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |         |                                              |                                   |                                 |
| ar. 9, a. m. ....  |                   | 6.28                               | 143,486                       | .....                                            | 143,486                                            | 2M      | 12                                           | 15                                | Calm.                           |
| ar. 9, p. m. ....  |                   | 6.25                               | 142,867                       | .....                                            | 142,867                                            | F       | 9                                            | 15                                | XII light.                      |
| ar. 10, a. m. .... | — 81              | 6.28                               | 142,680                       | .....                                            | 142,680                                            | 2M      | 11                                           | 15                                | I light.                        |
| ar. 10, p. m. .... | + 26              | 6.27                               | 142,462                       | .....                                            | 142,462                                            | 2M      | 8                                            | 17                                | III brisk.                      |
| ar. 11, .....      | —787              | 6.19                               | 134,940                       | .....                                            | 134,940                                            | 2M      | 13                                           | 22                                | III strong.                     |
| ar. 12, a. m. .... | +260              | 6.10                               | 130,411                       | .....                                            | 130,411                                            | 2M      | 10                                           | 11                                | V light.                        |
| ar. 12, a. m. .... |                   | 5.75                               | 122,520                       | .....                                            | 122,520                                            | F       | 8                                            | 11                                | IX light.                       |
| ar. 12, p. m. .... | — 84              | 5.93                               | 124,896                       | .....                                            | 124,896                                            | 2M      | 10                                           | 11                                | Calm.                           |
| ar. 13, .....      | +343              | 5.62                               | 112,838                       | .....                                            | 112,838                                            | 2M      | 9                                            | 10                                | III brisk.                      |

<sup>1</sup> Interpolated.

The discharge section was located practically in the same place as that used in 1913. The readings tabulated in the standard gauge column are the 8 a. m. readings on the United States Engineer gauge at Nashville, Tenn.; those tabulated in the local gauge column are on the same gauge at the time of measuring the discharge. The zero of the gauge is 366.17 feet above mean sea level. Datum areas were computed below 45.75 feet on the gauge. In the column headed Method, 2M denotes mean of simultaneous measurements with two meters, and F denotes double floats. The meters were run at six-tenths depth, and the lower float at mid-depth. Price meters Nos. 244 and 322 were used. Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, Secretary Mississippi River Commission. Reduction made under the direction of E. J. Thomas, assistant engineer, secretary Mississippi River Commission.

TABLE NO. 3.--Results of discharge observations, Tennessee River, at River ton, Ala. (225 miles from mouth).

| Date.               | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|---------------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|                     | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|                     |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width        |
| 1917.               | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Mar. 12, a. m. .... | 24.70                   | 4.50         | .....                     | 53,167                      | 53,440          | 42.8         | 43.0           | 49.5          | 1.2          |
| Mar. 12, p. m. .... |                         | 4.60         | .....                     | 53,005                      | 53,154          | 42.6         | 42.8           | 49.5          | 1.2          |
| Mar. 13.....        | 24.30                   | 4.72         | -0.4                      | 52,702                      | 52,702          | 42.4         | 42.4           | 49.7          | 1.2          |
| Mar. 14, a. m. .... | 23.50                   | 4.38         | - .8                      | 52,275                      | 52,698          | 42.1         | 42.4           | 48.5          | 1.2          |
| Mar. 14, p. m. .... |                         | 4.23         | .....                     | <sup>1</sup> 52,130         |                 |              |                |               | 1.2          |
| Mar. 15, a. m. .... | 21.90                   | 3.10         | -1.6                      | 51,027                      | 53,040          | 41.1         | 42.7           | 47.7          | 1.2          |
| Mar. 15, p. m. .... |                         | 2.85         | .....                     | <sup>1</sup> 50,717         |                 |              |                |               | 1.2          |
| Mar. 16, a. m. .... | 19.20                   | 0.9          | -2.7                      | 47,712                      | 52,449          | 38.6         | 42.4           | 51.5          | 1.2          |
| Mar. 16, p. m. .... |                         | 0.35         | .....                     | <sup>1</sup> 47,032         |                 |              |                |               | 1.2          |

| Date.               | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Method. | Number<br>of velocity<br>sta-<br>tions. | Number<br>of sound-<br>ings. | Direction and<br>force of wind |
|---------------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|---------|-----------------------------------------|------------------------------|--------------------------------|
| 1917.               | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |         |                                         |                              |                                |
| Mar. 12, a. m. .... |                   | 6.63                               | 352,384                       | 34,400                                           | 386,784                                            | 2M      | 13                                      | 25                           | V brisk.                       |
| Mar. 12, p. m. .... | -286              | 6.58                               | 348,842                       | 35,000                                           | 383,842                                            | 2M      | 13                                      | 51                           | V brisk<br>light.              |
| Mar. 13.....        | -452              | 6.21                               | 327,284                       | 35,606                                           | 362,890                                            | 2M      | 12                                      | 32                           | IV light<br>brisk.             |
| Mar. 14, a. m. .... | - 4               | 6.38                               | 333,385                       | 33,200                                           | 366,585                                            | 2M      | 13                                      | 28                           | IX light.                      |
| Mar. 14, p. m. .... |                   | 5.81                               | 302,616                       | 32,200                                           | 334,816                                            | F       | 13                                      | .....                        | IX light.                      |
| Mar. 15, a. m. .... | +342              | 5.60                               | 285,708                       | 24,104                                           | 309,812                                            | 2M      | 12                                      | 26                           | XII light.                     |
| Mar. 15, p. m. .... |                   | 5.65                               | 286,314                       | 22,500                                           | 308,814                                            | 2M      | 12                                      | .....                        | V very light                   |
| Mar. 16, a. m. .... | -591              | 5.15                               | 245,714                       | 10,500                                           | 256,214                                            | 2M      | 12                                      | 45                           | I very light.                  |
| Mar. 16, p. m. .... |                   | 4.82                               | 226,607                       | 8,000                                            | 234,607                                            | F       | 12                                      | .....                        | III to V light<br>to brisk.    |

<sup>1</sup> Interpolated.

The discharge section is opposite upstream end of platform of railway depot.

The standard gauge readings taken at 8 a. m. on the United States Engineer gauge at Florence, Ala. the zero of which is 400.85 feet above mean sea level.

The local gauge readings were taken at mean time of velocity observations on a temporary gauge on the discharge section. Zero of local gauge was 397.5 feet above mean sea level.

Datum areas were computed below 4.72 feet on the local gauge.

The overbank discharge was measured on March 13 and 15, and computed for other days.

In the column headed method, F indicates double floats and 2M the mean of two meters. Price meters Nos. 323 and 324 were used. The lower float was run at mid-depth, and the meters at six-tenths depth. Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Yazoo River, at Redwood, Miss. (18 miles above mouth).

| Date.        | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |                    |
|--------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------------|
|              | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |                    |
|              |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.             |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i>       |
| Apr. 22..... | <sup>1</sup> 49.90      | .....        | <sup>1</sup> 0.0          | <sup>2</sup> 32,539         | .....           | 33.4         | .....          | 73.9          | <sup>3</sup> 1,045 |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     | M            | 7                                            | 31                                | Calm.                           |
| Apr. 22..... | .....             | 0.66                               | 21,600                        | .....                                            | 21,600                                             |              |                                              |                                   |                                 |

<sup>1</sup> United States Engineer gauge at Vicksburg; elevation of zero 46.16 feet above mean Gulf level.<sup>2</sup> Does not include area occupied by piers.<sup>3</sup> 975 feet after deducting width of piers.

The discharge section was at the Yazoo and Mississippi Valley Railway bridge near Redwood, Miss. Velocity was measured with Price meter No. 324, run at six-tenths depth.

Observation made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Black River, at Jonesville, La. (54 miles above mouth).

| Date.        | Gauges.                 |                    |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.             | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |                    |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i>       | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 27..... | <sup>1</sup> 47.60      | <sup>2</sup> 48.53 | .....                     | 37,846                      | .....           | 33.6         | .....          | 60.4          | 1,125        |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     | F            | 3                                            | 23                                | II Light.                       |
| Apr. 27..... | .....             | 0.57                               | 21,615                        | .....                                            | 21,615                                             |              |                                              |                                   |                                 |

<sup>1</sup> Red River Landing United States Engineer gauge. Zero is 3.57 feet above mean Gulf level.<sup>2</sup> Elevation of water surface above mean Gulf level as determined by levels from P. B. M. 4.

TABLE NO. 3.—Results of discharge observations, Little River, at Jonesville, La

| Date.        | Gauges.                 |                    |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.             | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |                    |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i>       | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 27..... | <sup>1</sup> 47.60      | <sup>2</sup> 48.53 | .....                     | 10,267                      | .....           | 23.1         | .....          | 50.0          | 44           |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Apr. 27..... | .....             | 0.72                               | 7,440                         | .....                                            | 7,440                                              | F            | 3                                            | 10                                | II Light.                       |

<sup>1</sup> Red River Landing United States Engineer gauge. Zero is 3.57 feet above mean Gulf level.<sup>2</sup> Elevation of water surface above mean Gulf level as determined by levels from P. B. M. 4.

The discharge section on Black River is in front of Yancey's house.

The discharge section on Little River is 15 feet below (away from Black River) edge of wagon bridge over Little River.

The water in Little River was flowing away from Black River.

The sum of the discharges of both the above tabulated sections constitutes the total discharge of Black River.

In Black River the direction of flow was toward Red River.

Velocities were measured by means of double floats, the lower float being run at mid-depth.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Old River, at Texas & Pacific Railroad bridge (2½ miles from mouth).

| Date.      | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|            | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|            |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.      | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| r. 15..... | 45.60                   | 46.96        | +0.3                      | 39,690                      | 42,036          | 34.5         | 36.6           | 60.0          | 1,150        |
| r. 17..... | 46.20                   | 47.5         | + .3                      | 39,808                      | 41,533          | 34.6         | 36.1           | 61.2          | 1,150        |
| r. 19..... | 46.65                   | 47.9         | + .2                      | 41,925                      | 43,190          | 36.5         | 37.6           | 63.2          | 1,150        |
| r. 21..... | 47.15                   | 48.5         | + .3                      | 42,836                      | 43,411          | 37.2         | 37.7           | 69.2          | 1,150        |
| r. 23..... | 47.40                   | 48.82        | + .1                      | 43,725                      | 43,932          | 38.0         | 38.2           | 69.0          | 1,150        |
| r. 25..... | 47.50                   | 49.00        | .0                        | 43,622                      | 43,622          | 37.9         | 37.9           | 65.8          | 1,150        |

| Date.      | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.      | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| r. 15..... | —                 | 6.41                               | 254,312                       | <sup>1</sup> 24,100                              | 278,412                                            | 2M           | 5                                            | 47                                | Calm.                           |
| r. 17..... | — 503             | 6.36                               | 253,116                       | <sup>2</sup> 31,428                              | 284,544                                            | 2M           | 5                                            | 38                                | XII light.                      |
| r. 19..... | +1,657            | 6.18                               | 259,074                       | <sup>1</sup> 37,700                              | 296,774                                            | 2M           | 5                                            | 34                                | III light.                      |
| r. 21..... | + 221             | 6.24                               | 267,168                       | <sup>1</sup> 47,200                              | 314,368                                            | 2M           | 5                                            | 34                                | Calm.                           |
| r. 23..... | + 521             | 6.13                               | 267,964                       | <sup>2</sup> 52,603                              | 320,567                                            | 2M           | 5                                            | 31                                | Do.                             |
| r. 25..... | — 310             | 5.88                               | 256,519                       | <sup>1</sup> 55,800                              | 312,319                                            | 2M           | 5                                            | 29                                | Do.                             |

<sup>1</sup> From curve for overbank discharge, derived from "a."

<sup>2</sup> Measured.

Current runs from Mississippi River toward the Atchafalaya River.

In the standard gauge column are tabulated the 8 a. m. readings of the Red River Landing U. S. E. gauge of which the zero is 3.57 feet above mean Gulf level. The change in 24 hours is taken from this gauge. The local gauge was at the T. & P. R. R. bridge and the readings tabulated were taken at the time of the corresponding discharge observations.

Datum areas were computed below 49 feet on the local gauge.

In the method column 2M denotes the mean of simultaneous measurements by two meters run at six-inches depth.

Price meters Nos. 309 and 310 were used.

The discharge section was about 200 feet below the T. & P. R. R. bridge.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, U. S. Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 3.—Results of discharge observations, Atchafalaya River, at Simmesport, La. (5.5 miles below head).

| Date.        | Gauges.                 |              |                           | Cross section of discharge. |                 |              |                |               |              |
|--------------|-------------------------|--------------|---------------------------|-----------------------------|-----------------|--------------|----------------|---------------|--------------|
|              | Stand-<br>ard<br>gauge. | Local.       | Change<br>in 24<br>hours. | Area.                       |                 | Depth.       |                |               |              |
|              |                         |              |                           | Water.                      | Below<br>datum. | Mean.        | Mean<br>datum. | Maxi-<br>mum. | Width.       |
| 1917.        | <i>Feet.</i>            | <i>Feet.</i> | <i>Feet.</i>              | <i>Sq. ft.</i>              | <i>Sq. ft.</i>  | <i>Feet.</i> | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i> |
| Apr. 14..... | 38.3                    | 0.1          | +0.4                      | 58,805                      | 61,730          | 52.3         | 54.9           | 80.8          | 1,100        |
| Apr. 16..... | 38.9                    | .7           | + .3                      | 59,696                      | 61,946          | 53.1         | 55.1           | 78.9          | 1,100        |
| Apr. 17..... | 39.2                    | .8           | + .3                      | 59,549                      | 61,687          | 52.9         | 54.8           | 80.9          | 1,100        |
| Apr. 18..... | 39.4                    | 1.1          | + .2                      | 60,336                      | 62,136          | 53.6         | 55.2           | 83.0          | 1,100        |
| Apr. 19..... | 39.7                    | 1.3          | + .3                      | 61,190                      | 62,765          | 54.4         | 55.8           | 81.4          | 1,100        |
| Apr. 21..... | 40.3                    | 2.0          | + .4                      | 60,825                      | 61,613          | 54.1         | 54.8           | 83.2          | 1,100        |
| Apr. 23..... | 40.8                    | 2.35         | + .3                      | 61,661                      | 62,055          | 54.8         | 55.2           | 83.3          | 1,100        |
| Apr. 24..... | 40.9                    | 2.62         | + .1                      | 61,772                      | 61,862          | 54.9         | 55.0           | 82.1          | 1,100        |
| Apr. 25..... | 41.1                    | 2.7          | + .2                      | 62,829                      | 62,829          | 55.8         | 55.8           | 84.0          | 1,100        |

| Date.        | Scour<br>or fill. | Mean<br>velocity<br>per<br>second. | Discharge<br>per sec-<br>ond. | Dis-<br>charge<br>over<br>bank<br>per<br>second. | Total<br>discharge<br>of river<br>per sec-<br>ond. | Meth-<br>od. | Num-<br>ber of<br>velocity<br>sta-<br>tions. | Num-<br>ber of<br>sound-<br>ings. | Direction and<br>force of wind. |
|--------------|-------------------|------------------------------------|-------------------------------|--------------------------------------------------|----------------------------------------------------|--------------|----------------------------------------------|-----------------------------------|---------------------------------|
| 1917.        | <i>Sq. ft.</i>    | <i>Feet.</i>                       | <i>Cu. ft.</i>                | <i>Cu. ft.</i>                                   | <i>Cu. ft.</i>                                     |              |                                              |                                   |                                 |
| Apr. 14..... |                   | 4.26                               | 250,366                       | .....                                            | 250,366                                            | 2M           | 5                                            | 25                                | XII light                       |
| Apr. 16..... | + 216             | 4.26                               | 254,362                       | .....                                            | 254,362                                            | 2M           | 5                                            | 38                                | III light.                      |
| Apr. 17..... | - 259             | 4.33                               | 257,554                       | .....                                            | 257,554                                            | 2M           | 5                                            | 28                                | Calm.                           |
| Apr. 18..... | + 449             | 4.23                               | 255,520                       | .....                                            | 255,520                                            | 2M           | 5                                            | 28                                | VI light.                       |
| Apr. 19..... | + 631             | 4.18                               | 255,787                       | .....                                            | 255,787                                            | 2M           | 5                                            | 32                                | Calm.                           |
| Apr. 21..... | -1,152            | 4.42                               | 269,053                       | .....                                            | 269,053                                            | 2M           | 5                                            | 29                                | VI light.                       |
| Apr. 23..... | +1,442            | 4.38                               | 269,888                       | .....                                            | 269,888                                            | 2M           | 5                                            | 29                                | Calm.                           |
| Apr. 24..... | - 193             | 4.41                               | 272,190                       | .....                                            | 272,190                                            | 2M           | 5                                            | 32                                | II light.                       |
| Apr. 25..... | + 967             | 4.49                               | 281,862                       | .....                                            | 281,862                                            | 2M           | 5                                            | 36                                | Calm.                           |

The location of the discharge section is approximately that of the 1916 section.

The readings tabulated in the standard gauge column are the 7 a. m. readings of the United States Weather Bureau gauge at Simmesport, La. Elevation of zero of gauge, 5.79 feet above mean Gulf level. The local gauge readings are from a gauge at the discharge section, read at the time the measurements were made.

Datum areas were computed below 2.7 feet on the local gauge.

Under the heading of method, 2M denotes the mean of two meters run simultaneously at six-tenths depth. Price meters Nos. 309 and 310 were used.

Observations made under the direction of Maj. Clarke S. Smith, Corps of Engineers, United States Army, secretary, Mississippi River Commission.

Reduction made under the direction of E. J. Thomas, assistant engineer, secretary, Mississippi River Commission.

TABLE No. 4.—Cost of dredging operations, May 1, 1917, to April 30, 1918.

| Class of work, or plant to which distributed.                     | Labor.      | Office supplies. | Subsistence. | Fuel.       | Lighting supplies. | Lubricants. |
|-------------------------------------------------------------------|-------------|------------------|--------------|-------------|--------------------|-------------|
| Cost of plant.....                                                | \$41,090.26 | \$85.52          | \$14,248.98  | \$12,704.94 | \$306.55           | \$505.41    |
| Costs of floating plant:                                          |             |                  |              |             |                    |             |
| Dredge Beta.....                                                  | 72.19       |                  | 28.38        |             | .53                |             |
| Dredge Gamma.....                                                 | 3,527.47    |                  | 1,046.77     |             | 26.28              | 127.28      |
| Dredge Delta.....                                                 | 2,194.12    |                  | 542.76       |             | 20.01              | 115.32      |
| Dredge Epsilon.....                                               | 1,709.27    |                  | 450.50       |             | 14.43              | 5.29        |
| Dredge Zeta.....                                                  | 3,930.50    |                  | 1,114.38     |             | 26.79              | 67.24       |
| Dredge Iota.....                                                  | 4,020.42    |                  | 1,090.99     |             | 45.95              | 43.95       |
| Dredge Kappa.....                                                 | 3,679.21    |                  | 988.87       |             | 22.96              | 78.04       |
| Dredge Henry Flad.....                                            | 3,981.21    |                  | 1,018.70     |             | 42.13              | 118.49      |
| Dredge B. M. Harrod.....                                          | 6,442.33    |                  | 1,592.39     |             | 41.25              | 89.80       |
| Steamer Sachem.....                                               | 1,189.41    |                  | 321.97       |             | .74                | 5.16        |
| Steamer Choctaw.....                                              | 2,078.43    |                  | 531.70       |             | 3.32               | 28.33       |
| Steamer Leota.....                                                | 1,304.03    |                  | 348.28       |             | 9.58               | 83.87       |
| Steamer Inspector.....                                            | 2,556.10    |                  | 721.85       |             | 12.07              | 24.83       |
| Steamer Saturn.....                                               | 711.09      |                  | 202.50       |             | 4.62               | 13.47       |
| Steamer Jupiter.....                                              | 985.42      |                  | 263.94       |             | 5.60               | 2.24        |
| Steamer Vulcan.....                                               | 202.14      |                  | 46.79        |             | .27                | 9.87        |
| Steamer Venus.....                                                | 289.87      |                  | 73.93        |             | .77                | .46         |
| Steamer Mars.....                                                 | 364.22      |                  | 94.84        |             | 1.35               | 11.91       |
| Steamer Mercury.....                                              | 114.10      |                  | 36.68        |             | .51                | 7.78        |
| Pile sinker No. 13.....                                           | 133.67      |                  | 39.82        |             | .73                |             |
| Pile sinker No. 971.....                                          | 123.57      |                  | 32.18        |             |                    |             |
| Pile sinker No. 981.....                                          | 751.96      |                  | 216.77       |             | 1.68               |             |
| Pile sinker No. 982.....                                          | 148.40      |                  | 36.12        |             | .57                | 5.88        |
| Pile sinker No. 983.....                                          | 298.91      |                  | 69.20        |             | .46                | 1.37        |
| Pump boat.....                                                    | 33.26       |                  | 6.44         |             |                    |             |
| Barge No. 041.....                                                | 36.37       |                  | 9.90         |             |                    |             |
| Barge No. 051.....                                                | 18.89       |                  | 4.36         |             | .22                |             |
| Skiffs.....                                                       | 722.49      |                  | 145.27       |             |                    |             |
| Motor boat M. R. C. No. 1.....                                    | 37.04       |                  | 8.10         |             |                    |             |
| Motor boat M. R. C. No. 2.....                                    |             |                  |              |             |                    |             |
| Floating derrick M. R. C. No. 1.....                              | 120.30      |                  | 22.10        |             |                    | 5.40        |
| Total.....                                                        | 41,776.39   |                  | 11,106.48    |             | 282.82             | 845.98      |
| Operations during low-water season, 1917:                         |             |                  |              |             |                    |             |
| Dredge Gamma.....                                                 | 11,148.35   | 14.83            | 4,326.71     | 6,093.71    | 75.38              | 697.37      |
| Dredge Iota.....                                                  | 9,560.02    | 12.48            | 3,230.22     | 5,191.67    | 48.19              | 328.97      |
| Dredge Kappa.....                                                 | 548.50      |                  | 199.06       | 136.00      |                    |             |
| Dredge Henry Flad.....                                            | 11,284.30   | 11.01            | 3,531.90     | 5,251.76    | 73.00              | 414.01      |
| Dredge B. M. Harrod.....                                          | 11,409.53   | 10.59            | 3,853.12     | 6,214.44    | 29.31              | 307.15      |
| Steamer Inspector.....                                            | 8,111.79    | 12.21            | 2,211.06     | 5,379.41    | 30.96              | 252.41      |
| Steamer Saturn.....                                               | 3,083.36    | 34.60            | 1,001.86     | 829.16      | 28.31              | 35.75       |
| Steamer Jupiter.....                                              | 3,302.02    | 21.45            | 1,581.59     | 2,297.51    | 37.92              | 32.70       |
| Steamer Venus.....                                                | 2,919.70    | 41.17            | 805.61       | 781.47      | 28.54              | 56.06       |
| Total.....                                                        | 61,367.62   | 158.34           | 20,746.13    | 32,175.13   | 351.61             | 2,124.42    |
| Idle-haul railway dry dock, repairs to buildings and grounds..... | 2,205.44    |                  | 605.52       |             | .12                | 6.55        |
| Outfit, care, and repair of.....                                  | 2,738.13    |                  | 739.31       |             | 6.59               | 237.90      |
| Permanent outfit.....                                             | 5,869.63    |                  | 1,467.06     |             | 21.65              | 12.35       |
| Miscellaneous:                                                    |             |                  |              |             |                    |             |
| Handling materials.....                                           | 1,464.24    |                  | 383.52       |             |                    |             |
| Buoys, construction of.....                                       | 402.34      |                  | 144.70       |             |                    |             |
|                                                                   | 1,866.58    |                  | 528.22       |             |                    |             |
| Total cost of dredging operations.....                            | 159,914.05  | 243.86           | 49,441.70    | 43,968.07   | 686.52             | 2,886.63    |

TABLE NO. 4.—*Cost of dredging operations, May 1, 1917, to April 30, 1918—Con*

| Class of work, or plant to which distributed. | Material. | Perma-<br>nent<br>plant and<br>outfit. | Hire of<br>plant and<br>renewals. | Repairs<br>(nonper-<br>sonal serv-<br>ice and<br>material). | Total.     | Grand<br>total. |
|-----------------------------------------------|-----------|----------------------------------------|-----------------------------------|-------------------------------------------------------------|------------|-----------------|
| Care of plant.....                            | \$375.79  |                                        |                                   |                                                             |            | \$69,317.       |
| Repairs to floating plant:                    |           |                                        |                                   |                                                             |            |                 |
| Dredge Beta.....                              | 343.09    |                                        |                                   |                                                             |            |                 |
| Dredge Gamma.....                             | 2,912.64  |                                        |                                   | \$7.50                                                      | \$444.19   |                 |
| Dredge Delta.....                             | 2,614.98  |                                        |                                   |                                                             | 7,647.94   |                 |
| Dredge Epsilon.....                           | 605.07    |                                        |                                   |                                                             | 5,487.19   |                 |
| Dredge Zeta.....                              | 1,876.09  |                                        |                                   |                                                             | 2,784.56   |                 |
| Dredge Iota.....                              | 1,965.75  |                                        |                                   |                                                             | 7,015.00   |                 |
| Dredge Kappa.....                             | 2,362.77  |                                        |                                   | 2.50                                                        | 7,167.06   |                 |
| Dredge Henry Flad.....                        | 1,038.59  |                                        |                                   | 6,850.00                                                    | 7,134.35   |                 |
| Dredge B. M. Harrod.....                      | 3,668.59  |                                        |                                   | 9,150.00                                                    | 13,049.12  |                 |
| Steamer Sachem.....                           | 523.59    |                                        |                                   |                                                             | 20,984.36  |                 |
| Steamer Choctaw.....                          | 1,244.88  |                                        |                                   |                                                             | 2,040.87   |                 |
| Steamer Leota.....                            | 645.05    |                                        |                                   |                                                             | 3,886.66   |                 |
| Steamer Inspector.....                        | 1,756.47  |                                        |                                   | 35.00                                                       | 2,390.81   |                 |
| Steamer Saturn.....                           | 333.63    |                                        |                                   |                                                             | 5,106.32   |                 |
| Steamer Jupiter.....                          | 372.88    |                                        |                                   | 23.25                                                       | 1,265.31   |                 |
| Steamer Vulcan.....                           | 149.11    |                                        |                                   |                                                             | 1,653.33   |                 |
| Steamer Venus.....                            | 210.03    |                                        |                                   |                                                             | 408.18     |                 |
| Steamer Mars.....                             | 129.18    |                                        |                                   |                                                             | 575.06     |                 |
| Steamer Mercury.....                          | 42.35     |                                        |                                   |                                                             | 601.50     |                 |
| Pile sinker No. 13.....                       | 78.47     |                                        |                                   |                                                             | 201.42     |                 |
| Pile sinker No. 971.....                      | 6.90      |                                        |                                   |                                                             | 252.69     |                 |
| Pile sinker No. 981.....                      | 136.05    |                                        |                                   |                                                             | 162.65     |                 |
| Pile sinker No. 982.....                      | 39.08     |                                        |                                   |                                                             | 1,106.46   |                 |
| Pile sinker No. 983.....                      | 87.06     |                                        |                                   |                                                             | 230.05     |                 |
| Pump boat.....                                |           |                                        |                                   |                                                             | 457.00     |                 |
| Barge No. 041.....                            | .05       |                                        |                                   |                                                             | 39.70      |                 |
| Barge No. 051.....                            | 1.92      |                                        |                                   |                                                             | 46.32      |                 |
| Skiffs.....                                   | 37.61     |                                        |                                   |                                                             | 25.39      |                 |
| Motor boat M. R. C. No. 1.....                | 11.44     |                                        |                                   |                                                             | 905.37     |                 |
| Motor boat M. R. C. No. 2.....                | 16.20     |                                        |                                   |                                                             | 56.58      |                 |
| Floating derrick M. R. C. No. 1.....          | 28.90     |                                        |                                   |                                                             | 16.20      |                 |
| Total.....                                    | 23,238.42 |                                        |                                   | 16,068.25                                                   | 176.70     | 93,318.         |
| Operations during low-water season,<br>1917:  |           |                                        |                                   |                                                             |            |                 |
| Dredge Gamma.....                             | 289.94    |                                        |                                   |                                                             | 22,646.29  |                 |
| Dredge Iota.....                              | 438.46    |                                        |                                   |                                                             | 18,810.01  |                 |
| Dredge Kappa.....                             |           |                                        |                                   |                                                             | 883.56     |                 |
| Dredge Henry Flad.....                        | 361.53    |                                        |                                   |                                                             | 20,927.51  |                 |
| Dredge B. M. Harrod.....                      | 204.04    |                                        |                                   |                                                             | 22,033.23  |                 |
| Steamer Inspector.....                        | 83.03     |                                        |                                   |                                                             | 16,080.87  |                 |
| Steamer Saturn.....                           | 118.98    |                                        |                                   |                                                             | 5,132.02   |                 |
| Steamer Jupiter.....                          | 40.73     |                                        |                                   |                                                             | 7,313.92   |                 |
| Steamer Venus.....                            | 93.78     |                                        |                                   |                                                             | 4,726.33   |                 |
| Total.....                                    | 1,630.49  |                                        |                                   |                                                             | 118,553.74 | 118,553.        |
| Side-haul railway dry dock, repairs to.       | 1,200.42  |                                        |                                   |                                                             |            | 4,018.          |
| Buildings and grounds.....                    | 896.32    |                                        |                                   | 1.22                                                        |            | 4,619.          |
| Outfit, care, and repair of.....              | 446.15    |                                        |                                   |                                                             |            | 7,816.          |
| Permanent outfit.....                         |           | \$14,424.68                            |                                   |                                                             |            | 14,424.         |
| Miscellaneous:                                |           |                                        |                                   |                                                             |            |                 |
| Handling materials.....                       | 43.28     |                                        |                                   |                                                             |            | 1,891.          |
| Buoys, construction of.....                   | 114.96    |                                        |                                   |                                                             |            | 662.            |
| Total.....                                    | 158.24    |                                        |                                   |                                                             |            | 2,553.          |
| Total cost of dredging operations.            | 4,707.41  | 14,424.68                              |                                   | 16,069.47                                                   |            | 314,621.        |

TABLE NO. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1917.*

## CAIRO TO MEMPHIS.

NOTE.—The depths tabulated are merely those recorded by the inspection steamer in passing. No attempt was made to locate and record the minimum depth of water in the thalweg of the crossing.]

| Name of crossing.           | Miles below Cairo. | Dates of trips. |                |                |               |                 |
|-----------------------------|--------------------|-----------------|----------------|----------------|---------------|-----------------|
|                             |                    | Aug. 15 to 16.  | Aug. 22 to 23. | Aug. 29 to 31. | Sept. 5 to 6. | Sept. 12 to 13. |
|                             |                    | <i>Feet.</i>    | <i>Feet.</i>   | <i>Feet.</i>   | <i>Feet.</i>  | <i>Feet.</i>    |
| Cairo gauge.....            | 0                  | 15.5-15.5       | 15-14.8        | 14-13          | 12-11.9       | 12.3-12.8       |
| New Madrid gauge.....       | 70                 | 11.5-11.9       | 10.9-11.1      | 10.4-9.7       | 8.7-8.6       | 8.8-8.9         |
| Meys Chute.....             | 76                 | <sup>1</sup> 13 |                |                |               |                 |
| Saint Pleasant.....         | 80                 | <sup>1</sup> 13 |                |                |               |                 |
| Arnells.....                | 82                 | 16              |                |                |               |                 |
| Huddles Point.....          | 85                 |                 |                |                |               |                 |
| Perokee.....                | 89                 |                 |                |                |               |                 |
| Fitz.....                   | 101                |                 |                |                |               |                 |
| Pathaway.....               | 102                |                 |                |                |               |                 |
| Andy Hook.....              | 103                |                 |                |                |               |                 |
| Wayoso.....                 | 104                | <sup>2</sup> 9  |                |                |               |                 |
| Truthersville Bend.....     | 114                |                 |                |                |               |                 |
| Foot Island 16 (upper)..... | 120                |                 |                | 13             | 11            |                 |
| Foot Island 16 (lower)..... | 121                | 15              |                |                |               | 14              |
| Head Island 18.....         | 122                | 15              |                |                |               |                 |
| Wottonwood Point gauge..... | 123                | 8.4-8.6         | 7.7-7.8        | 7.3-6.6        | 5.4-5.3       | 5.4-5.3         |
| Witchells.....              | 125                |                 |                |                |               |                 |
| Head Island 20.....         | 128                | 15              |                |                | 12            | 14              |
| Blue Grass.....             | 132                | 10½             |                | 12             | 10            | 10              |
| Sales Point.....            | 136                |                 |                |                |               |                 |
| Over Styx.....              | 139                | 10              | 10             | 10             | 11            | 9               |
| Worked Deer.....            | 146                |                 |                |                | 17            |                 |
| Foot Island 26.....         | 153                | 12              | 12             | 11             | 11            | 12              |
| Head Island 30, chute.....  | 160                | 16              | 15             |                | 13            |                 |
| Foot Island 30, chute.....  | 161                | 13              | 13             | 12             | 12            | 12              |
| Lum Point.....              | 165                | 10              |                |                |               |                 |
| Winters.....                | 169                |                 | 10½            |                | 11            | 11              |
| Lower Island.....           | 171                |                 |                | <sup>3</sup> 8 |               |                 |
| Wilton gauge.....           | 175                | 9.7-9.6         | 9.1-9.2        | 8.7-8.2        | 7.1-7.0       | 7.1-7.0         |
| Sawmill Point.....          | 180                |                 |                |                |               |                 |
| Random Shot.....            | 196                |                 | 12             |                |               |                 |
| Bean Point.....             | 198                |                 |                |                | 12            | 14              |
| Adar Point.....             | 201                |                 |                |                |               |                 |
| Corona.....                 | 204                | 15              | 15             |                | 12            | 12              |
| Fassey Point.....           | 205                |                 |                |                |               |                 |
| Old River.....              | 209                |                 |                |                | 11            |                 |
| Brandywine.....             | 211                |                 |                |                |               |                 |
| St. Clair.....              | 223                | 15              | 17             | 18             | 11            | 11              |
| Arthur.....                 | 225                |                 |                |                |               |                 |
| Waddys Hen.....             | 227                | 16              |                |                |               |                 |
| Memphis gauge.....          | 230                | 11.2-10.9       | 10.4-10.3      | 9.8-9.3        | 8.2-8.0       | 7.8-7.9         |

<sup>1</sup> Reported by survey boat.<sup>2</sup> From survey.<sup>3</sup> Not controlling depth.

TABLE NO. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low water season of 1917—Continued.*

## CAIRO TO MEMPHIS—Continued.

| Name of crossing.           | Miles below Cairo. | Dates of trips. |                 |              |              |               |
|-----------------------------|--------------------|-----------------|-----------------|--------------|--------------|---------------|
|                             |                    | Sept. 19 to 20. | Sept. 25 to 26. | Sept. 28.    | Oct. 2 to 4. | Oct. 9 to 10. |
|                             |                    | <i>Feet.</i>    | <i>Feet.</i>    | <i>Feet.</i> | <i>Feet.</i> | <i>Feet.</i>  |
| Cairo gauge.....            | 0                  | 12.3-12.0       | 9.4-8.7         | 8.2          | 10.2-10.5    | 9-8.          |
| New Madrid gauge.....       | 70                 | 8.8-8.5         | 6.7-6.2         | 5.7          | 6.2-7.2      | 6.2-5.        |
| Toneys Chute.....           | 76                 |                 |                 |              |              |               |
| Point Pleasant.....         | 80                 | 9               |                 |              | 9½           |               |
| Darnells.....               | 82                 | 11              |                 |              | 13           | 12            |
| Ruddles Point.....          | 85                 | 15              |                 |              | 14           | 12            |
| Cherokee.....               | 89                 |                 |                 |              |              | 11            |
| Fritz.....                  | 101                | 14              |                 |              | 14           | 12            |
| Hathaway.....               | 102                | 12              |                 |              |              |               |
| Sandy Hook.....             | 103                |                 |                 |              | 12           | 12            |
| Gayoso.....                 | 104                | 12              |                 |              | 10           | 9             |
| Caruthersville.....         | 114                |                 |                 |              |              | 12            |
| Foot Island 16 (upper)..... | 120                |                 | 10              |              |              |               |
| Foot Island 16 (lower)..... | 121                | 12              |                 |              | 11           | 11            |
| Head Island 18.....         | 122                |                 |                 |              |              |               |
| Cottonwood Point gauge..... | 123                | 5.6-5.3         | 3.7-3.1         | 2.6          | 2.1-3.7      | 2.9-2.        |
| Mitchells.....              | 125                |                 | 12              |              | 13           |               |
| Head Island 20.....         | 128                |                 | 12              |              | 13           | 12            |
| Blue Grass.....             | 132                | 10              | 12              |              | 12           | 12            |
| Hales Point.....            | 136                |                 | 11              |              | 11           | 11            |
| River Styx.....             | 139                | 13              | 11              |              | 12           | 12            |
| Forked Deer.....            | 146                |                 |                 |              |              |               |
| Foot Island 26.....         | 153                | 14              | 11              |              | 11           | 12            |
| Head Island 30, chute.....  | 160                |                 | 15              |              | 10           | 12            |
| Foot Island 30, chute.....  | 161                | 14              | 11              |              | 9            | 11            |
| Plum Point..... chute.....  | 165                |                 |                 |              |              |               |
| Drivers.....                | 169                | 11              | 11              | 9½           | 11           | 11            |
| Flower Island.....          | 171                |                 |                 |              |              |               |
| Fulton gauge.....           | 175                | 7.5-7.1         | 5.6-5.0         | 4.4          | 3.7-5.2      | 4.8-4.        |
| Sawmill Point.....          | 180                |                 |                 |              |              |               |
| Random Shot.....            | 196                |                 |                 |              |              | 11            |
| Pecan Point.....            | 198                |                 | 10              | 10           | 14           | 12            |
| Cedar Point.....            | 201                |                 |                 | 12           | 10           | 11            |
| Corona.....                 | 204                |                 | 11              | 10           | 10½          | 11            |
| Massey Point.....           | 205                |                 |                 |              | 11           | 11            |
| Old River.....              | 209                |                 | 12              | 12           |              |               |
| Brandywine.....             | 211                |                 |                 |              | 11           | 11            |
| St. Clair.....              | 223                | 13              | 12              | 13           | 13           | 12            |
| Arthur.....                 | 225                |                 |                 | 12           |              |               |
| Paddys Hen.....             | 227                | 13              | 14              | 15           | 14           | 11            |
| Memphis gauge.....          | 230                | 8.4-8.1         | 6.6-6.1         | 5.5          | 4.5-5.9      | 5.7-5.        |

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1917—Continued.*

## CAIRO TO MEMPHIS—Continued.

| Name of crossing.        | Miles below Cairo. | Dates of trips.         |                           |                           |                          |                         |
|--------------------------|--------------------|-------------------------|---------------------------|---------------------------|--------------------------|-------------------------|
|                          |                    | Oct. 16 to 17.          | Oct. 31 to Nov. 1.        | Nov. 13 to 14.            | Nov. 20 to 21.           | Nov. 27 to 28.          |
| to gauge.....            | 0                  | <i>Feet.</i><br>7.6-7.2 | <i>Feet.</i><br>13.9-13.8 | <i>Feet.</i><br>16.7-15.4 | <i>Feet.</i><br>10.4-9.7 | <i>Feet.</i><br>8.8-9.2 |
| Madrid gauge.....        | 70                 | 4.8-4.6                 | 9.4-9.6                   | 12.5-11.5                 | 7.3-6.6                  | 5.6-5.7                 |
| Boys Chute.....          | 76                 | .....                   | .....                     | .....                     | .....                    | .....                   |
| St Pleasant.....         | 80                 | .....                   | .....                     | .....                     | .....                    | .....                   |
| Wells.....               | 82                 | 12                      | .....                     | .....                     | .....                    | .....                   |
| Idles Point.....         | 85                 | 11                      | .....                     | .....                     | .....                    | .....                   |
| Prokee.....              | 89                 | .....                   | .....                     | .....                     | .....                    | .....                   |
| .....                    | 101                | 11                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 102                | .....                   | .....                     | .....                     | .....                    | .....                   |
| .....                    | 103                | 12                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 104                | 9½                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 114                | 12                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 120                | .....                   | .....                     | .....                     | .....                    | .....                   |
| .....                    | 121                | 10½                     | 15                        | 17                        | 13                       | 12                      |
| .....                    | 122                | .....                   | .....                     | .....                     | .....                    | .....                   |
| tonwood Point gauge..... | 123                | 1.5-1.4                 | 5.4-6.0                   | 10-8.9                    | 4.4-3.5                  | 2.1-2.2                 |
| .....                    | 125                | 11                      | .....                     | .....                     | .....                    | 11                      |
| .....                    | 128                | 12                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 132                | 11                      | 15                        | 18                        | 14                       | 11½                     |
| .....                    | 136                | 11                      | 14                        | .....                     | 13                       | 11½                     |
| .....                    | 139                | 12                      | 12                        | 17                        | 13                       | 11½                     |
| .....                    | 146                | 15                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 153                | 13                      | 15                        | .....                     | 17                       | 13                      |
| .....                    | 160                | .....                   | .....                     | .....                     | 16                       | .....                   |
| .....                    | 161                | 10                      | 15                        | 14                        | 13½                      | 11                      |
| .....                    | 165                | .....                   | .....                     | .....                     | .....                    | .....                   |
| .....                    | 169                | 11                      | 14                        | 17                        | 15                       | 9                       |
| .....                    | 171                | .....                   | .....                     | .....                     | .....                    | .....                   |
| ton gauge.....           | 175                | 3.3-3.2                 | 6.9-7.4                   | 11-10.3                   | 6.6-5.7                  | 4-4                     |
| .....                    | 180                | 14                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 196                | 13                      | .....                     | .....                     | .....                    | .....                   |
| .....                    | 198                | 10                      | 12                        | .....                     | 14                       | 13                      |
| .....                    | 201                | 11                      | .....                     | .....                     | 13                       | 10½                     |
| .....                    | 204                | 9½                      | 15                        | .....                     | 15                       | 13                      |
| .....                    | 205                | 13                      | 15                        | .....                     | 16                       | 16                      |
| .....                    | 209                | .....                   | .....                     | .....                     | 13                       | 16                      |
| .....                    | 211                | 12                      | 16                        | .....                     | .....                    | .....                   |
| .....                    | 223                | 12                      | 13                        | .....                     | 13                       | 9                       |
| .....                    | 225                | .....                   | .....                     | .....                     | .....                    | .....                   |
| .....                    | 227                | 12                      | .....                     | .....                     | .....                    | 14                      |
| mpphis gauge.....        | 230                | 4.1-4.1                 | 7-8.1                     | 12.3-11.5                 | 7.5-6.6                  | 4.6-4.6                 |

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low water season of 1917—Continued.*

CAIRO TO MEMPHIS—Continued.

| Name of crossing.           | Miles below Cairo. | Dates of trips.         |                       |                       |
|-----------------------------|--------------------|-------------------------|-----------------------|-----------------------|
|                             |                    | Dec. 4 to 5.            | Dec. 11 to 12.        | Dec. 20 to 22.        |
| Cairo gauge.....            | 0                  | <i>Feet.</i><br>8.4-8.2 | <i>Feet.</i><br>8-6.8 | <i>Feet.</i><br>5.8-7 |
| New Madrid gauge.....       | 70                 | 5.4-5.1                 | 4.8-4                 | 2.9                   |
| Toneys Chute.....           | 76                 |                         |                       |                       |
| Point Pleasant.....         | 80                 |                         |                       |                       |
| Darnells.....               | 82                 |                         |                       |                       |
| Ruddles Point.....          | 85                 |                         |                       |                       |
| Cherokee.....               | 89                 |                         |                       |                       |
| Fritz.....                  | 101                |                         |                       |                       |
| Hathaway.....               | 102                |                         |                       |                       |
| Sandy Hook.....             | 103                |                         |                       |                       |
| Gayoso.....                 | 104                |                         |                       |                       |
| Caruthersville Bend.....    | 114                |                         |                       |                       |
| Foot Island 16 (upper)..... | 120                |                         |                       |                       |
| Foot Island 16 (lower)..... | 121                | 12                      | 10½                   |                       |
| Head Island 18.....         | 122                |                         |                       |                       |
| Cottonwood Point gauge..... | 123                | 2.1-1.8                 | 1.4-0.7               | 0                     |
| Mitchells.....              | 125                |                         |                       |                       |
| Head Island 20.....         | 128                |                         |                       |                       |
| Blue Grass.....             | 132                | 11                      | 11                    |                       |
| Hales Point.....            | 136                | 12                      |                       |                       |
| River Styx.....             | 139                | 12                      | 10                    |                       |
| Forked Deer.....            | 146                |                         |                       |                       |
| Foot Island 26.....         | 153                | 13                      | 13                    |                       |
| Head Island 30, chute.....  | 160                | 14                      |                       |                       |
| Foot Island 30, chute.....  | 161                | 12                      | 11                    |                       |
| Plum Point.....             | 165                |                         |                       |                       |
| Drivers.....                | 169                | 11                      | 12                    |                       |
| Flower Island.....          | 171                |                         |                       |                       |
| Fulton gauge.....           | 175                | 4.1-3.8                 | 3.4-3                 | 3.4                   |
| Sawmill Point.....          | 180                |                         |                       |                       |
| Random Shot.....            | 196                |                         |                       |                       |
| Pecan Point.....            | 198                | 12                      | 11                    |                       |
| Cedar Point.....            | 201                | 10½                     | 10½                   |                       |
| Corona.....                 | 204                | 12                      | 11                    |                       |
| Massey Point.....           | 205                |                         |                       |                       |
| Old River.....              | 209                | 16                      |                       |                       |
| Brandywine.....             | 211                |                         |                       |                       |
| St. Clair.....              | 223                | 10½                     | 10½                   |                       |
| Arthur.....                 | 225                |                         |                       |                       |
| Paddys Hen.....             | 227                |                         |                       |                       |
| Memphis gauge.....          | 230                | 4.7-4.5                 | 3.7-3.2               | 0.1                   |

TABLE No. 5.—*Depths over shoal crossings, Mississippi River below Cairo, low-water season of 1917—Continued.*

## MEMPHIS TO VICKSBURG.

| Name of crossing.          | Miles below Cairo. | Dates of trips. |              |              |                     |                |
|----------------------------|--------------------|-----------------|--------------|--------------|---------------------|----------------|
|                            |                    | Sept. 24.       | Sept. 27.    | Oct. 5 to 6. | Oct. 18 to 23.      | Nov. 21 to 25. |
|                            |                    | <i>Feet.</i>    | <i>Feet.</i> | <i>Feet.</i> | <i>Feet.</i>        | <i>Feet.</i>   |
| Memphis gauge.....         | 230                | 7.0             | 5.9          | 6.1-6.2      | 4.1-3.4             | 6.8-4.9        |
| Four Mile Bayou.....       | 234                |                 | 13           |              | 11                  |                |
| Winkley's.....             | 237                |                 | 15           |              |                     |                |
| Small Point.....           | 239                | 13              | 12           | 13           | 18½                 | 17             |
| Old Josie Harry Chute..... | 243                |                 | 19           |              |                     |                |
| At Josie Harry Chute.....  | 247                | 14              | 15           | 17           | 15                  | 16             |
| Folk Landing.....          | 252                | 9½              |              |              |                     |                |
| At Cow Island.....         | 254                |                 | 2 8½         | 12           | 19                  | 12             |
| At Cat Island.....         | 256                | 12              |              | 12           | 11                  | 14             |
| Soto.....                  | 257                |                 |              | 13           |                     |                |
| Depolls.....               | 259                |                 |              | 12           | 10                  | 11             |
| Good Landing gauge.....    | 276                | 4.1             | 2.4          | 1.8-2.5      | { -0.6<br>to -1.6 } | 4.2-1.1        |
| At Walnut Bend.....        | 284                |                 |              | 14           |                     | 9              |
| Seneca gauge.....          | 306                |                 |              | 4.9-5.7      | 3.4-2.6             | 8.1-5.2        |
| Stover.....                | 318                |                 |              | 13           | 12                  |                |
| End 63.....                | 328                |                 |              | 12           | 11                  | 14             |
| Flower Landing gauge.....  | 353                |                 |              | 5-6          | 3.8-3.5             | 8.8-5.5        |
| At Island 68.....          | 361                |                 |              | 12           |                     | 15             |
| At Island 68.....          | 364                |                 |              |              | 9                   |                |
| Winkley's.....             | 376                |                 |              |              | 11                  | 15             |
| Arico.....                 | 386                |                 |              |              | 12                  | 15             |
| At White River gauge.....  | 393                |                 |              | 9.2-10.1     | 8.2-7.2             | 14.1-10.4      |
| Kansas City gauge.....     | 438                |                 |              | 6-7          | 5.6-5.2             | 12.2-8.3       |
| St. Lake.....              | 455                |                 |              |              | 11                  | 15             |
| At Lake.....               | 476                |                 |              |              | 12                  | 16             |
| At Lake gauge.....         | 478                |                 |              | 3.3-3.4      | 3.1-2.3             | 8.3-5.0        |
| At Lake.....               | 486                |                 |              |              | 12                  |                |
| At Lake.....               | 511                |                 |              |              | 11                  |                |
| At Lake.....               | 529                |                 |              |              | 9½                  |                |
| At Lake.....               | 535                |                 |              |              | 11½                 | 16             |
| At Providence gauge.....   | 542                |                 |              | 3.2-3.1      | 2.5-1.6             | 8.7-5.1        |
| At Providence.....         | 555                |                 |              |              |                     | 15             |
| At Providence.....         | 565                |                 |              |              | 11                  |                |
| At Providence.....         | 573                |                 |              |              | 9½                  | 16             |
| At Providence gauge.....   | 599                |                 |              | 5.3-5        | 4.6-3.6             | 10.4-7.2       |

<sup>1</sup> Not controlling depth.

<sup>2</sup> Not thoroughly investigated.

TABLE NO. 6.—*Dimensions of channel through bars, Mississippi River below Cairo, dredging season 1917, determined from surveys.*

| Miles below Cairo. | Name of crossing.        | Date of survey, 1917. | Least depth in channel 250 feet wide. | Least width of 9-foot channel. | Gauges and their readings at time of survey. |                 |                    |
|--------------------|--------------------------|-----------------------|---------------------------------------|--------------------------------|----------------------------------------------|-----------------|--------------------|
|                    |                          |                       |                                       |                                | Readings.                                    |                 | Standard gauge at— |
|                    |                          |                       |                                       |                                | Local gauge.                                 | Standard gauge. |                    |
|                    |                          |                       | <i>Feet.</i>                          | <i>Feet.</i>                   | <i>Feet.</i>                                 | <i>Feet.</i>    |                    |
| 70                 | Morrissons.....          | Sept. 18.....         | 16                                    | 3,700                          | 9.2                                          | 9.2             | New Madrid.        |
|                    |                          | Sept. 27.....         | 10                                    | 630                            | 5.9                                          | 6.0             |                    |
|                    |                          | Oct. 6.....           | 13                                    | 1,350                          | 6.8                                          | 6.1             |                    |
|                    |                          | Oct. 13.....          | 13                                    | 960                            | 5.1                                          | 5.0             | Do.                |
| 78                 | Toneys.....              | Sept. 1.....          | 14                                    | 2,000                          | 9.5                                          | 9.5             |                    |
| 80                 | Point Pleasant.....      | Aug. 13.....          | 13                                    | 2,400                          | 11.7                                         | 11.8            |                    |
|                    |                          | Aug. 17.....          | 14                                    | 2,100                          | 11.7                                         | 11.8            | Do.                |
|                    |                          | Aug. 23.....          | 13                                    | 2,000                          | 11.1                                         | 11.1            |                    |
|                    |                          | Sept. 1.....          | 12.5                                  | 670                            | 9.5                                          | 9.5             |                    |
|                    |                          | Sept. 6.....          | 9.5                                   | 300                            | 7.5                                          | 8.6             | Do.                |
|                    |                          | Sept. 17.....         | 10                                    | 2,500                          | 9.5                                          | 9.5             |                    |
|                    |                          | Sept. 23.....         | 11.5                                  | 370                            | 7.4                                          | 7.6             |                    |
|                    |                          | Oct. 2.....           | 10.5                                  | 650                            | 6.6                                          | 6.2             | Do.                |
|                    |                          | Oct. 13.....          | 13.5                                  | 430                            | 5.1                                          | 5.0             |                    |
|                    |                          | Oct. 19.....          | 13                                    | 300                            | 4.5                                          | 4.3             |                    |
|                    |                          | Nov. 22.....          | 12.5                                  | 650                            | 6.2                                          | 6.3             | Do.                |
|                    |                          | Dec. 3.....           | 12                                    | 600                            | 5.7                                          | 5.6             |                    |
| 82                 | Darnells.....            | Sept. 28.....         | 13                                    | 1,050                          | 5.7                                          | 5.7             |                    |
| 85                 | Ruddles Point.....       | Sept. 28.....         | 13                                    | 700                            | 5.7                                          | 5.7             | Do.                |
| 104                | Gayoso.....              | Aug. 11.....          | 11                                    | 1,000                          | 9.9                                          | 9.8             | Do.                |
|                    |                          | Aug. 15.....          | 9                                     | 600                            | 8.4                                          | 8.4             |                    |
|                    |                          | Aug. 20.....          | 9                                     | 250                            | 7.8                                          | 7.8             |                    |
|                    |                          | Sept. 4.....          | 8                                     | 200                            | 5.8                                          | 5.6             | Do.                |
|                    |                          | Sept. 8.....          | 8                                     | 200                            | 5.3                                          | 5.1             |                    |
|                    |                          | Sept. 12.....         | 9                                     | 275                            | 5.6                                          | 5.4             |                    |
|                    |                          | Sept. 19.....         | 10.5                                  | 300                            | 5.8                                          | 5.6             | Cottonwood Po      |
|                    |                          | Sept. 24.....         | 11.5                                  | 350                            | 4.1                                          | 4.1             |                    |
|                    |                          | Oct. 3.....           | 9                                     | 300                            | 3.7                                          | 2.9             |                    |
|                    |                          | Oct. 9.....           | 8                                     | 180                            | 3.2                                          | 2.9             | Do.                |
|                    |                          | Oct. 20.....          | 10                                    | 260                            | 1.1                                          | .9              |                    |
|                    |                          | Oct. 26.....          | 8.5                                   | 150                            | 1.4                                          | .8              |                    |
|                    |                          | Nov. 16.....          | 11                                    | 700                            | 7.2                                          | 7.5             | Do.                |
|                    |                          | Dec. 5.....           | 11                                    | 300                            | 2.2                                          | 1.9             |                    |
| 121                | Foot Island 16.....      | Oct. 15.....          | 10.5                                  | 800                            | 1.8                                          | 1.5             |                    |
|                    |                          | Oct. 22.....          | 9                                     | 700                            | .9                                           | .7              | Fulton.            |
| 132                | Blue Grass.....          | Aug. 15.....          | 10.5                                  | 750                            | 9.5                                          | 9.7             |                    |
|                    |                          | Aug. 24.....          | 12.5                                  | 1,000                          | 9.0                                          | 9.2             |                    |
|                    |                          | Sept. 7.....          | 10                                    | 340                            | 7.0                                          | 7.0             | Do.                |
|                    |                          | Sept. 28.....         | 11                                    | 300                            | 5.0                                          | 4.4             |                    |
|                    |                          | Oct. 21.....          | 10.5                                  | 1,050                          | 3.0                                          | 2.6             |                    |
|                    |                          | Oct. 29.....          | 14                                    | 1,000                          | 3.9                                          | 3.4             | Cottonwood Po      |
| 139                | River Styx.....          | Aug. 19.....          | 10                                    | 1,000                          | 9.5                                          | 9.6             |                    |
|                    |                          | Sept. 13.....         | 11.5                                  | 600                            | 7.0                                          | 7.1             |                    |
|                    |                          | Sept. 29.....         | 11.5                                  | 320                            | 4.5                                          | 2.3             | Do.                |
|                    |                          | Oct. 10.....          | 11                                    | 350                            | 4.5                                          | 2.7             |                    |
|                    |                          | Oct. 25.....          | 10                                    | 300                            | 3.0                                          | .7              |                    |
|                    |                          | Nov. 21.....          | 12                                    | 580                            | 6.0                                          | 3.7             | Fulton.            |
| 155                | Ashport.....             | Sept. 9.....          | 12                                    | 1,160                          | 7.0                                          | 6.8             |                    |
| 161                | Foot of Island 30, chute | Sept. 11.....         | 11                                    | 1,250                          | 7.0                                          | 6.9             |                    |
|                    |                          | Sept. 24.....         | 11.5                                  | 1,300                          | 6.0                                          | 6.1             | Do.                |
|                    |                          | Oct. 13.....          | 9.5                                   | 600                            | 4.5                                          | 3.6             |                    |
|                    |                          | Oct. 22.....          | 12                                    | 640                            | 2.5                                          | 2.6             |                    |
|                    |                          | Nov. 23.....          | 12                                    | 670                            | 4.5                                          | 4.9             | Do.                |
| 169                | Drivers.....             | Aug. 11-12.....       | 10.5                                  | 1,280                          | 11-10.5                                      | 11-10.4         |                    |
|                    |                          | Aug. 27-28.....       | 11.5                                  | 440                            | 8.0                                          | 8.8-8.8         |                    |
|                    |                          | Sept. 12.....         | 10                                    | 410                            | 7.0                                          | 7.1             | Do.                |
|                    |                          | Sept. 25.....         | 11                                    | 300                            | 6.0                                          | 5.6             |                    |
|                    |                          | Oct. 3.....           | 12.5                                  | 600                            | 4.5                                          | 4.2             |                    |
|                    |                          | Oct. 14.....          | 12                                    | 450                            | 4.5                                          | 3.5             | Do.                |
|                    |                          | Oct. 24.....          | 12.5                                  | 400                            | 3.0                                          | 2.4             |                    |
|                    |                          | Nov. 24.....          | 11                                    | 600                            | 4.0                                          | 4.5             |                    |
| 196                | Random Shot.....         | Oct. 28.....          | 12.5                                  | 550                            | 4.0                                          | 3.7             | Do.                |
| 201                | Cedar Point.....         | Sept. 30.....         | 11                                    | 1,150                          | 3.5                                          | 3.9             | Do.                |
| 204                | Corona.....              | Oct. 2.....           | 10                                    | 1,050                          | 4.5                                          | 4.5             | Memphis.           |
| 223                | St. Clair.....           | Dec. 7.....           | 11                                    | 425                            | 4.5                                          | 4.3             | Do.                |
| 239                | Dismal Point.....        | Sept. 12-13.....      | 14                                    | 1,450                          | 7.6                                          | 7.8-7.9         | Do.                |
|                    |                          | Nov. 6.....           | 22                                    | 2,500                          | 9.5                                          | 9.6             | Do.                |
| 252                | Cow Island, Foot.....    | Sept. 26.....         | 12                                    | 650                            | 6.5                                          | 6.2             |                    |
|                    |                          | Oct. 11.....          | 12.5                                  | 950                            | 5.0                                          | 5.2             |                    |

TABLE No. 6.—*Dimensions of channel through bars, Mississippi River below Cairo, dredging season 1917, determined from surveys—Continued.*

| Files<br>below<br>Cairo. | Name of crossing.    | Date of<br>survey, 1917. | Least<br>depth in<br>channel<br>250 feet<br>wide. | Least<br>width of<br>9-foot<br>channel. | Gauges and their readings at time<br>of survey. |                         |                         |
|--------------------------|----------------------|--------------------------|---------------------------------------------------|-----------------------------------------|-------------------------------------------------|-------------------------|-------------------------|
|                          |                      |                          |                                                   |                                         | Readings.                                       |                         | Standard gauge<br>at—   |
|                          |                      |                          |                                                   |                                         | Local<br>gauge.                                 | Stand-<br>ard<br>gauge. |                         |
|                          |                      |                          | <i>Feet.</i>                                      | <i>Feet.</i>                            | <i>Feet.</i>                                    | <i>Feet.</i>            |                         |
| 253                      | Helm, upper.....     | Sept. 11-12..            | 13                                                | 1,050                                   | 7.6                                             | 7.8-7.8                 | Memphis.                |
|                          |                      | Nov. 6.....              | 16                                                | ( <sup>1</sup> )                        | 9.5                                             | 9.5                     |                         |
|                          |                      | Nov. 30.....             | 9                                                 | 250                                     | 4.5                                             | 4.6                     |                         |
| 256                      | Cat Island.....      | Sept. 7-9.....           | 12                                                | 680                                     | 8.0                                             | 7.9-7.8                 | Do.                     |
|                          |                      | Sept. 24.....            | 10                                                | 800                                     | 6.5                                             | 7.0                     |                         |
|                          |                      | Nov. 5.....              | 19.5                                              | 1,200                                   | 9.0                                             | 8.9                     |                         |
| 328                      | Island 63, foot..... | Oct. 14-15....           | 15                                                | 600                                     | .....                                           | 4.1-3.8                 | Helena.                 |
| 573                      | Henderson.....       | Oct. 5.....              | 10                                                | 700                                     | 5.5                                             | 5.3                     | Vicksburg.              |
|                          |                      | Jan. 4, 1918..           | 14                                                | 1,300                                   | 3.5                                             | 3.0                     |                         |
| 710                      | Fords.....           | Oct. 23.....             | 12                                                | 450                                     | 5.2                                             | 5.1                     | Natchez.                |
|                          |                      | Oct. 31.....             | 12.5                                              | 950                                     | 4.5                                             | 4.6                     |                         |
|                          |                      | Nov. 26.....             | 25                                                | 1,700                                   | 9.0                                             | 9.1                     |                         |
| 766                      | Red River.....       | Nov. 1-3.....            | 7.7                                               | .....                                   | 4.0                                             | 4.0-4.3                 | Red River Land-<br>ing. |
|                          |                      | Nov. 8.....              | 12                                                | 1,600                                   | 7.8                                             | 7.7                     |                         |
|                          |                      | Nov. 28.....             | 13.5                                              | 1,900                                   | 7.5                                             | 7.8                     |                         |
| 764                      | Mouth Old River..... | Nov. 6.....              | 10.5                                              | 550                                     | 6.0                                             | 6.2                     | Do.                     |
|                          |                      | Dec. 3.....              | 9                                                 | 250                                     | 5.7                                             | 5.8                     |                         |
|                          |                      | Dec. 10.....             | 11                                                | 400                                     | 5.6                                             | 5.5                     |                         |

<sup>1</sup> Unlimited.TABLE No. 7.—*Summary of dredging operations, Mississippi River below Cairo, during the low-water season of 1917.*

GAMMA.

| Points of operation.                                 | Distribution of time.  |                         |                        |                       |                        |                        |                        |                                                     |                         |
|------------------------------------------------------|------------------------|-------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|-----------------------------------------------------|-------------------------|
|                                                      | Plac-<br>ing<br>plant. | Dredg-<br>ing.          | Chang-<br>ing<br>cuts. | Repair-<br>ing.       | Pass-<br>ing<br>boats. | Mak-<br>ing up<br>tow. | Tow-<br>ing.           | Not<br>working,<br>awaiting<br>lower<br>stage, etc. | Total.                  |
| Foot Cow Island (252),<br>Sept. 25-Oct. 9.....       | <i>Hours.</i><br>6.50  | <i>Hours.</i><br>144.25 | <i>Hours.</i><br>11.40 | <i>Hours.</i><br>0.30 | <i>Hours.</i><br>..... | <i>Hours.</i><br>..... | <i>Hours.</i><br>15.45 | <i>Hours.</i><br>1 169.50                           | <i>Hours.</i><br>349.00 |
| West Memphis (232), ly-<br>ing up Oct. 9-15.....     | .....                  | .....                   | .....                  | .....                 | .....                  | .....                  | 20.30                  | 122.00                                              | 142.30                  |
| Fords (710), Oct. 15-31...                           | 6.05                   | 74.40                   | 7.45                   | .....                 | .....                  | 3.10                   | 190.15                 | 2 101.35                                            | 383.30                  |
| Red River Crossing (766),<br>Oct. 31-Nov. 8.....     | 34.00                  | 62.40                   | 4.25                   | .....                 | .....                  | .....                  | 23.20                  | 3 63.45                                             | 188.10                  |
| Vicksburg (599), lying up<br>Nov. 8-27.....          | .....                  | .....                   | .....                  | .....                 | .....                  | .....                  | 4 140.40               | 5 317.10                                            | 457.50                  |
| Mouth Old River (764),<br>Nov. 27-Jan. 3, 1918...    | 16.00                  | 80.00                   | 12.15                  | .....                 | 6.05                   | 3.00                   | 54.00                  | 6 738.40                                            | 910.00                  |
| Going into winter quar-<br>ters Jan. 3-Feb. 15, 1918 | .....                  | .....                   | .....                  | 98.00                 | .....                  | .....                  | 7 395.15               | 8 531.45                                            | 1,025.00                |
| Total and average..                                  | 62.55                  | 361.45                  | 36.05                  | 98.30                 | 6.05                   | 6.10                   | 839.45                 | 2,044.45                                            | 3,456.00                |

<sup>1</sup> Includes 27.30 hours cleaning boilers.<sup>2</sup> Includes 55.15 hours cleaning boilers; 16.20 hours tied up to hire stokers, and 9.30 hours lost account wind and fog.<sup>3</sup> Includes 24 hours cleaning boilers.<sup>4</sup> Includes 18 hours lost account fog.<sup>5</sup> Includes 37 hours cleaning boilers.<sup>6</sup> Includes 78 hours cleaning boilers and 23.45 hours lost account sick firemen.<sup>7</sup> Includes 3 hours tied up account of storm.<sup>8</sup> Includes 516.30 hours tied up account of ice in river and 15.15 hours taking on supplies.

TABLE NO. 7.—Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1917—Continued.

## GAMMA—Continued.

| Points of operation.                                 | Distance towed.  | Number of cuts. | Total length of cuts. | Average rate of advance per hour. | Depth section lowered. | Average depth of cut. | Average steam pressure per square inch. | Average speed main pump revolutions per minute |
|------------------------------------------------------|------------------|-----------------|-----------------------|-----------------------------------|------------------------|-----------------------|-----------------------------------------|------------------------------------------------|
| Foot Cow Island (252), Sept. 25-Oct. 9.....          | <i>Miles.</i> 22 | 16              | <i>Feet.</i> 19,375   | <i>Feet.</i> 134                  | <i>Feet.</i> 15-16     | <i>Feet.</i> 5.2      | <i>Pounds.</i> 125                      | 14                                             |
| West Memphis (232), lying up Oct. 9-15....           | 22               |                 |                       |                                   |                        |                       |                                         |                                                |
| Fords (710), Oct. 15-31.                             | 478              | 9               | 10,400                | 139                               | 14                     | 4.3                   | 125                                     | 14                                             |
| Red River Crossing (766), Oct. 31-Nov. 8.            | 56               | 8               | 7,200                 | 115                               | 15                     | 5.4                   | 125                                     | 14                                             |
| Vicksburg (599), lying up Nov. 8-27.....             | 167              |                 |                       |                                   |                        |                       |                                         |                                                |
| Mouth Old River (764), Nov. 27-Jan. 3, 1918..        | 165              | 16              | 5,650                 | 71                                | 11-14                  | 7.1                   | 123                                     | 14                                             |
| Going into winter quarters Jan. 3-Feb. 15, 1918..... | 532              |                 |                       |                                   |                        |                       |                                         |                                                |
| Total and average..                                  | 1,442            | 49              | 42,625                | 118                               | 11-16                  | 5.3                   | 124                                     | 14                                             |

## IOTA.

| Points of operation.                           | Distribution of time. |                      |                     |                    |                     |                    |                     |                                         |                     |
|------------------------------------------------|-----------------------|----------------------|---------------------|--------------------|---------------------|--------------------|---------------------|-----------------------------------------|---------------------|
|                                                | Placing plant.        | Dredging.            | Changing cuts.      | Repairing.         | Passing boats.      | Making up tow.     | Towing.             | Not working, awaiting lower stage, etc. | Total.              |
| Drivers (169), Aug. 27-Sept. 16.....           | <i>Hours.</i> 5.45    | <i>Hours.</i> 132.50 | <i>Hours.</i> 11.00 | <i>Hours.</i> 7.10 | <i>Hours.</i> ..... | <i>Hours.</i> 1.50 | <i>Hours.</i> 98.45 | <i>Hours.</i> 1 231.40                  | <i>Hours.</i> 489.0 |
| Osceola T. H. (161), lying up Sept. 16-27..... | 2.00                  |                      |                     |                    |                     | .45                | 5.00                | 257.40                                  | 265.2               |
| Drivers (169), second time, Sept. 27-Oct. 3... | 3.50                  | 56.45                | 3.35                | 42.40              |                     |                    | 2.25                | 2 30.50                                 | 140.0               |
| Osceola T. H. (161), lying up Oct. 3-15.....   |                       |                      |                     | 48.00              |                     |                    | 1.10                | 243.50                                  | 293.0               |
| Foot Island 30 (161), Oct. 15-Nov. 23.....     | 2.05                  | 61.15                | 4.40                | 2.15               |                     |                    | .45                 | 860.00                                  | 931.0               |
| West Memphis (232), lying up Nov. 23-Dec. 3    |                       |                      |                     |                    |                     | 7.00               | 23.40               | 211.35                                  | 242.2               |
| Head Presidents Island (232), Dec. 3-6.....    | 7.25                  | 40.30                | 5.10                | 3.55               | 0.40                | 2.30               | 2.05                | 8.15                                    | 70.3                |
| West Memphis (232), lying up Dec. 6-20.....    |                       |                      |                     |                    |                     |                    | 1.55                | 350.50                                  | 352.4               |
| Total and average..                            | 21.05                 | 291.20               | 24.25               | 104.00             | .40                 | 12.05              | 135.45              | 2,194.40                                | 2,784.0             |

<sup>1</sup> Includes 33.45 hours cleaning boilers; 24 hours holiday; and 54 hours waiting on firemen and cleaning boilers.

<sup>2</sup> Includes 12.55 hours short of labor.

TABLE No. 7.—*Summary of dredging operations, Mississippi River below Cairo, during the low-water season of 1917—Continued.*

## IOTA—Continued.

| Points of operation.                             | Distance towed.  | Number of cuts. | Total length of cuts. | Average rate of advance per hour. | Depth suction lowered. | Average depth of cut. | Average steam pressure per square inch. | Average speed main pump, revolutions per minute. |
|--------------------------------------------------|------------------|-----------------|-----------------------|-----------------------------------|------------------------|-----------------------|-----------------------------------------|--------------------------------------------------|
| ivers (169), Aug. 27—Sept. 16.....               | <i>Miles.</i> 63 | 20              | <i>Feet.</i> 32,375   | <i>Feet.</i> 244                  | <i>Feet.</i> 16        | <i>Feet.</i> 4.2      | <i>Pounds.</i> 133                      | 165                                              |
| osceola T. H (161), lying up Sept. 16-27.....    | 8                |                 |                       |                                   |                        |                       |                                         |                                                  |
| ivers (169), second time, Sept. 27-Oct. 3.....   | 8                | 5               | 10,750                | 189                               | 15-16                  | 5.3                   | 134                                     | 164                                              |
| osceola T. H. (161), lying up Oct. 3-15.....     | 8                |                 |                       |                                   |                        |                       |                                         |                                                  |
| oot Island 30 (161), Oct. 15-Nov. 23.....        | 1                | 9               | 20,200                | 338                               | 14                     | 3.7                   | 132                                     | 164                                              |
| West Memphis (232), lying up Nov. 23-Dec. 3..... | 71               |                 |                       |                                   |                        |                       |                                         |                                                  |
| ead Presidents Island (232), Dec. 3-6.....       | 2                | 8               | 8,800                 | 218                               | 12                     | 3.2                   | 134                                     | 164                                              |
| West Memphis (232), lying up Dec. 6-20.....      | 2                |                 |                       |                                   |                        |                       |                                         |                                                  |
| Total and average                                | 163              | 42              | 72,125                | 248                               | 12-16                  | 4.1                   | 133                                     | 164                                              |

## HENRY FLAD.

| Points of operation.                             | Distribution of time. |           |                |            |                |                |                    |                                         | Total.   |
|--------------------------------------------------|-----------------------|-----------|----------------|------------|----------------|----------------|--------------------|-----------------------------------------|----------|
|                                                  | Placing plant.        | Dredging. | Changing cuts. | Repairing. | Passing boats. | Making up tow. | Towing.            | Not working, awaiting lower stage, etc. |          |
| Plum Point (165), lying up, Aug. 8-17.....       |                       |           |                |            |                | 2.40           | 69.25              | 154.10                                  | 226.15   |
| Blue Grass (132), Aug. 17-23.....                | 2.15                  | 68.25     | 2.00           | 10.55      |                |                | 26.15              | <sup>1</sup> 31.40                      | 141.30   |
| River Styx (139), Aug. 23-Sept. 20.....          | 2.30                  | 188.15    | 9.35           | 40.25      |                | 1.00           | 3.10               | <sup>2</sup> 430.00                     | 674.55   |
| Blue Grass (132), second time, Sept. 20-29.....  | .50                   | 110.05    | 11.45          | 1.35       |                |                | 3.45               | <sup>3</sup> 84.20                      | 212.20   |
| River Styx (139), Sept. 29-Oct. 11.....          |                       |           |                | 9.00       |                | .55            | 2.20               | 274.15                                  | 286.30   |
| Gavoso (104), Oct. 11-20.....                    | 8.35                  | 114.00    | 14.10          | 11.35      | 2.35           |                | 26.20              | <sup>4</sup> 49.25                      | 226.40   |
| Blue Grass (132), third time, Oct. 20-28.....    | 4.30                  | 28.00     | 2.35           | .15        |                | 1.25           | <sup>5</sup> 38.35 | <sup>6</sup> 110.30                     | 185.50   |
| River Styx (139), lying up, Oct. 28-Nov. 23..... |                       |           |                |            |                | 1.25           | 1.50               | 616.45                                  | 620.00   |
| Osceola (165), Nov. 23-Dec. 26.....              | 3.05                  | 17.10     |                |            |                | 1.10           | 5.40               | <sup>7</sup> 765.25                     | 792.30   |
| Going into winter quarters, Dec. 26-31.....      |                       |           |                |            |                | 2.15           | 24.30              | 110.45                                  | 137.30   |
| Total and average                                | 21.45                 | 525.55    | 40.05          | 73.45      | 2.35           | 10.50          | 201.50             | 2,627.15                                | 3,504.00 |

<sup>1</sup> Includes 11.30 hours cleaning boilers.<sup>2</sup> Includes 211.50 hours short firemen and 36 hours holiday.<sup>3</sup> Includes 9.20 hours sick firemen.<sup>4</sup> Includes 37.30 hours cleaning boilers and 5.25 hours short of labor.<sup>5</sup> Includes 7.55 hours coaling at Caruthersville.<sup>6</sup> Includes 20.15 hours short of labor.<sup>7</sup> Includes 61 hours lost account cold weather.

TABLE No. 7.—Summary of dredging operations, Mississippi River below Cairo during the low-water season of 1917—Continued.

## HENRY FLAD—Continued.

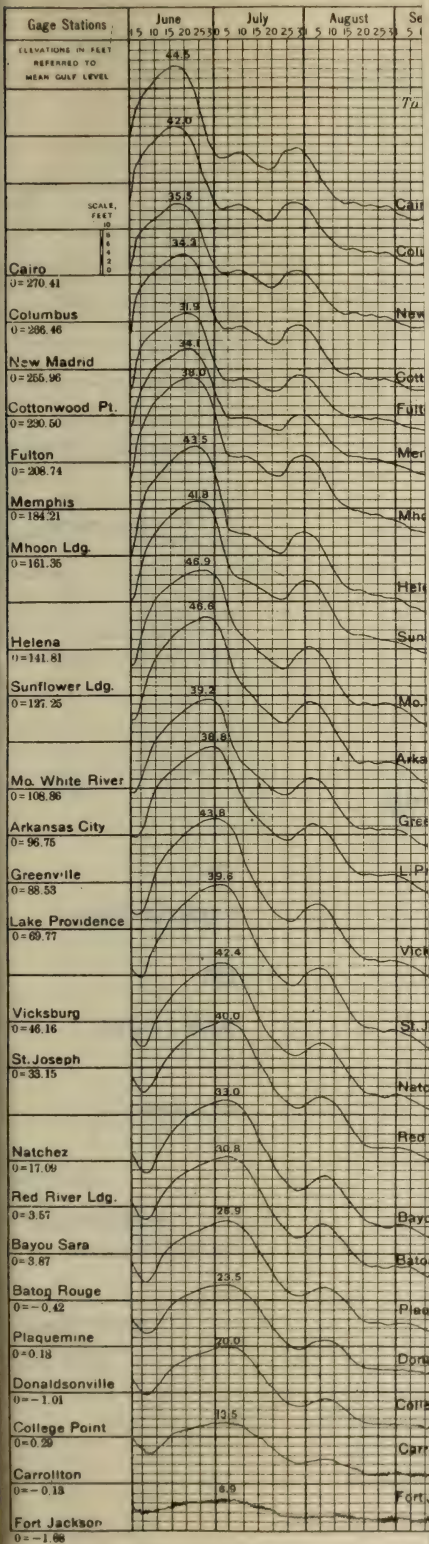
| Points of operation.                             | Distance towed. | Number of cuts. | Total length of cuts. | Average rate of advance per hour. | Depth suction lowered. | Average depth of cut. | Average steam pressure per square inch. | Average speed main pump revolution per minute. |
|--------------------------------------------------|-----------------|-----------------|-----------------------|-----------------------------------|------------------------|-----------------------|-----------------------------------------|------------------------------------------------|
|                                                  | Miles.          |                 | Feet.                 | Feet.                             | Feet.                  | Feet.                 | Pounds.                                 |                                                |
| Plum Point (165), lying up, Aug. 8-17.....       | 67              |                 |                       |                                   |                        |                       |                                         |                                                |
| Blue Grass (132), Aug. 17-23.....                | 33              | 5               | 7,025                 | 103                               | 17                     | 4.6                   | 116                                     |                                                |
| River Styx (139), Aug. 23-Sept. 20.....          | 7               | 16              | 36,850                | 196                               | 15-17                  | 3.7                   | 124                                     |                                                |
| Blue Grass (132), second time, Sept. 20-29.....  | 7               | 13              | 18,050                | 164                               | 15-16                  | 4.2                   | 124                                     |                                                |
| River Styx (139), Sept. 29-Oct. 11.....          | 7               |                 |                       |                                   |                        |                       |                                         |                                                |
| Gayoso (104), Oct. 11-20.....                    | 35              | 10              | 16,650                | 143                               | 14-15                  | 5.1                   | 124                                     |                                                |
| Blue Grass (132), third time, Oct. 20-28.....    | 28              | 8               | 5,250                 | 187                               | 14-16                  | 4.1                   | 126                                     |                                                |
| River Styx (139), lying up, Oct. 28-Nov. 23..... | 7               |                 |                       |                                   |                        |                       |                                         |                                                |
| Oseola (165), Nov. 23-Dec. 26.....               | 26              | 1               | 1,555                 | 91                                | 10-12                  | 5.1                   | 127                                     |                                                |
| Going into winter quarters, Dec. 26-31.....      | 67              |                 |                       |                                   |                        |                       |                                         |                                                |
| Total and average.                               | 284             | 53              | 85,390                | 162                               | 10-17                  | 4.2                   | 124                                     |                                                |

## B. M. HARROD.

| Points of operation.                             | Distribution of time. |           |                |            |                |                |                    |                                         |                   |
|--------------------------------------------------|-----------------------|-----------|----------------|------------|----------------|----------------|--------------------|-----------------------------------------|-------------------|
|                                                  | Placing plant.        | Dredging. | Changing cuts. | Repairing. | Passing boats. | Making up tow. | Towing.            | Not working, awaiting lower stage, etc. | Total.            |
|                                                  | Hours.                | Hours.    | Hours.         | Hours.     | Hours.         | Hours.         | Hours.             | Hours.                                  | Hours.            |
| Gayoso (104), Aug. 12-20.                        | 12.15                 | 28.05     | 0.40           | 1.15       | .....          | 6.00           | 79.15              | <sup>1</sup> 70.30                      | 198.              |
| Caruthersville (110), lying up, Aug. 20-Sept. 5. | .....                 | .....     | .....          | .....      | .....          | 1.30           | 2.00               | 381.30                                  | 385.              |
| Gayoso (104), second time, Sept. 5-16.....       | 5.15                  | 50.35     | 3.00           | 159.40     | 3.30           | 6.00           | 6.45               | 28.15                                   | <sup>2</sup> 263. |
| Point Pleasant (80), Sept. 16-22.....            | 4.00                  | 51.00     | 1.30           | 36.15      | .....          | 1.30           | 11.30              | 38.30                                   | 144.              |
| Caruthersville (110) Sept. 22-30.....            | .....                 | .....     | .....          | 185.30     | .....          | 3.45           | 4.30               | .....                                   | 193.              |
| Morrisons (70), Sept. 30-Oct. 6.....             | 4.45                  | 82.10     | 3.20           | .....      | .30            | .....          | 51.45              | <sup>3</sup> 4.30                       | 147.              |
| Point Pleasant (80), second time, Oct. 6-17..... | 5.00                  | 89.30     | 6.45           | .....      | .....          | 7.00           | 4.15               | <sup>4</sup> 148.20                     | 260.              |
| Caruthersville (110), lying up, Oct. 17-22.....  | .....                 | .....     | .....          | .....      | .....          | 1.20           | 4.40               | 117.25                                  | 123.              |
| Gayoso (104), third time, Oct. 22-25.....        | 2.30                  | 39.15     | 2.30           | .....      | .....          | .....          | 1.45               | <sup>5</sup> 26.00                      | 72.               |
| Caruthersville (110), lying up, Oct. 25-Dec. 26. | .....                 | .....     | .....          | .....      | .....          | 1.45           | <sup>6</sup> 65.15 | 1,421.45                                | 488.              |
| Going into winter quarters, Dec. 26-28.....      | .....                 | .....     | .....          | .....      | .....          | 12.00          | 32.45              | 15.15                                   | 60.               |
| Total and average.                               | 33.45                 | 340.35    | 17.45          | 382.40     | 4.00           | 40.50          | 264.25             | 2,252.00                                | 3,336.            |

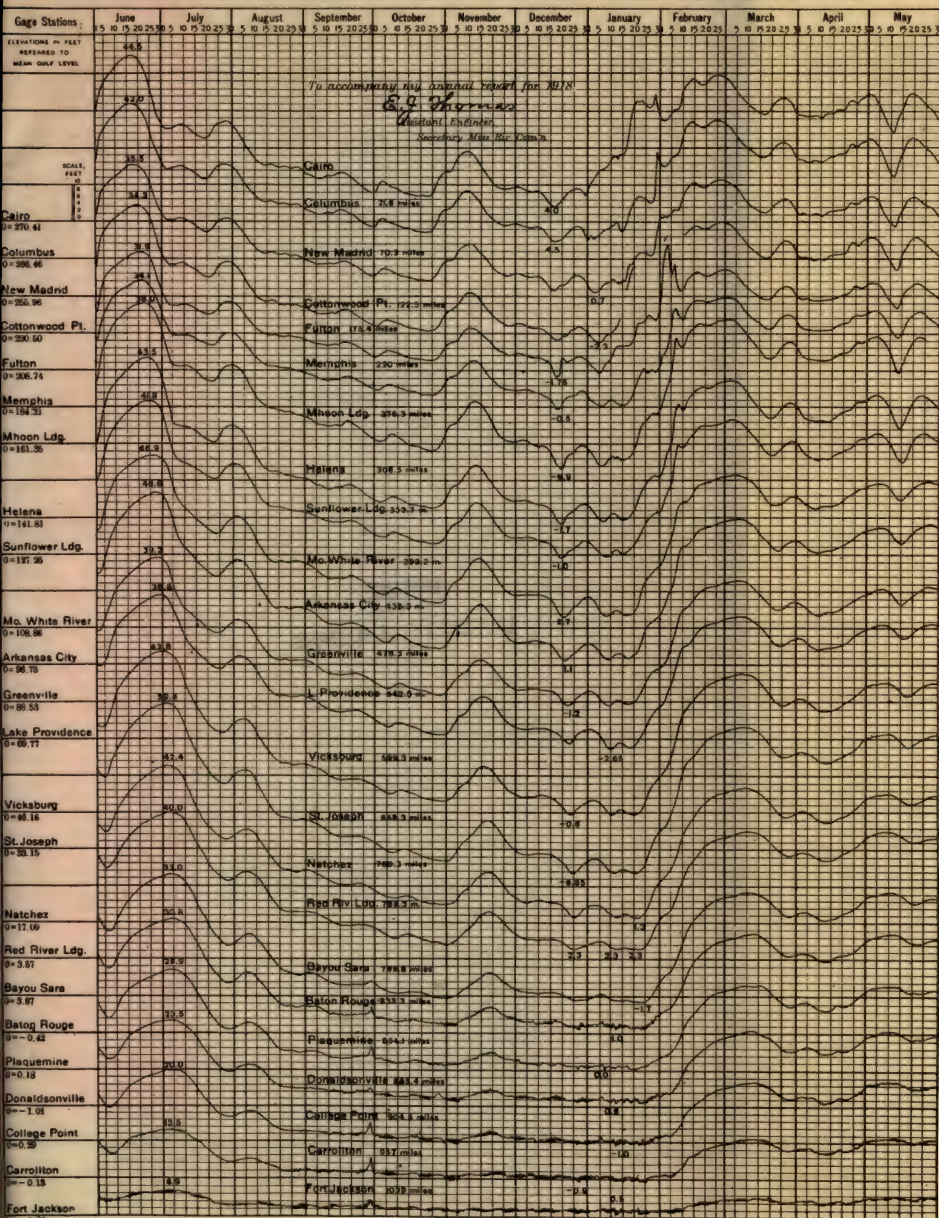
<sup>1</sup> Includes 17 hours short of labor, 13 hours cleaning boilers, and 12 hours half holiday.<sup>2</sup> Includes time at Caruthersville making repairs.<sup>3</sup> Cleaning boilers.<sup>4</sup> Includes 61 hours cleaning boilers, 24.15 hours short of labor, and 21.45 hours delayed by high wind.<sup>5</sup> Short of labor.<sup>6</sup> Includes 53.15 hours going to New Madrid to get steamers Barrett and Finley off ground and 11 hours to get steamer Saturn off ground.

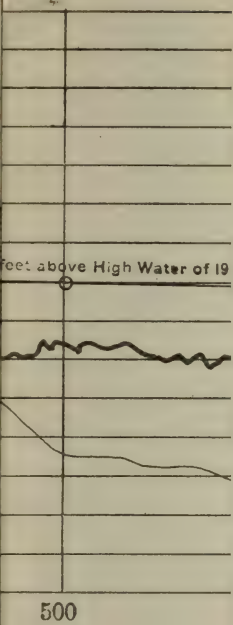
WAR DEPARTMENT  
HYDROGRAPHS OF THE MIS



Note. - The numerals on curves at high  
maximum and minimum gage re

## HYDROGRAPHS OF THE MISSISSIPPI RIVER CAIRO, ILL., TO FORT JACKSON, LA., 1917-18.





LEVEES BETWEEN

ML

RIGHT BAN



Submitted:

**E. L. HARMAN**

*Assistant Engineer*

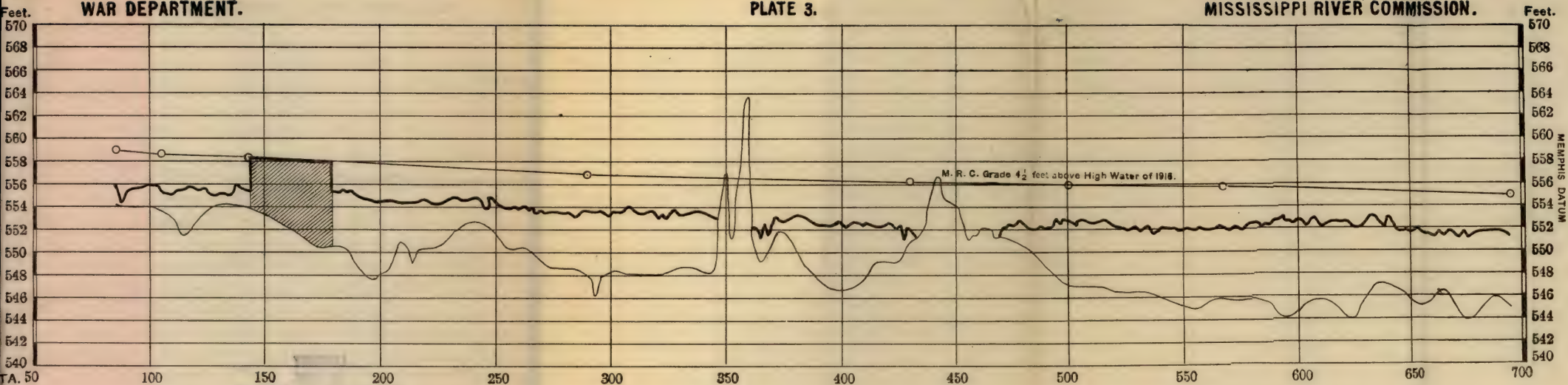
Drawn by H.d'A.

June, 1918.

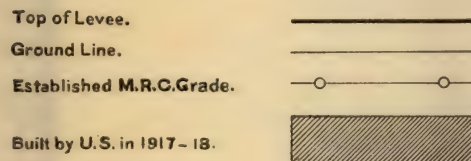
WAR DEPARTMENT.

PLATE 3.

MISSISSIPPI RIVER COMMISSION.



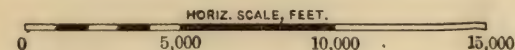
LEGEND.



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.

MUSCATINE ISLAND LEVEE

RIGHT BANK 481 TO 467 MILES ABOVE CAIRO.



Submitted:

E. L. HARMAN  
Assistant Engineer.

To accompany my Annual Report for 1918:

*E. J. Thomas*  
Assistant Engineer.  
Secretary, Mississippi River Commission.

Drawn by H. d' A.  
June, 1918.

M. R. C. Sheet 3.  
961

MISSISSIPPI RIVER COMMISSION



MISSISSIPPI RIVER COMMISSION  
NEW ORLEANS DISTRICT

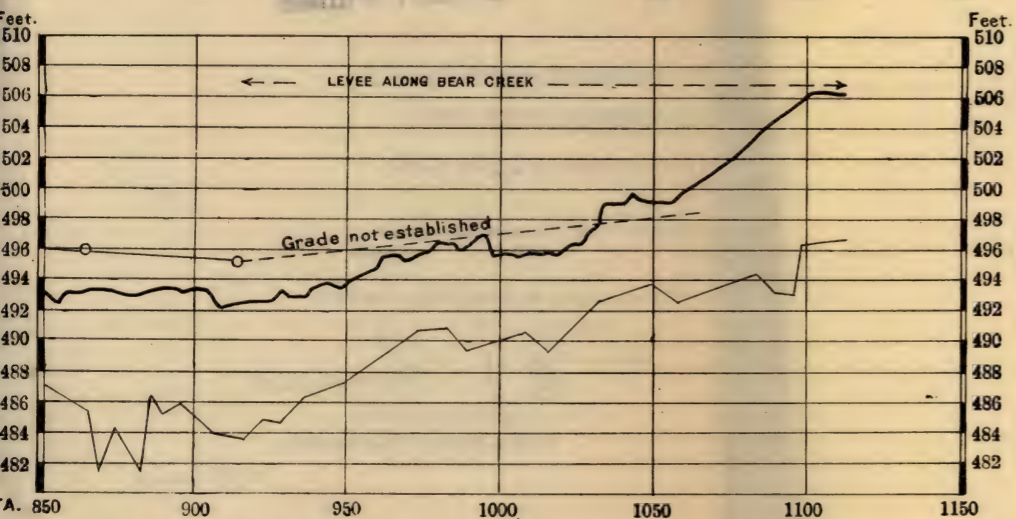
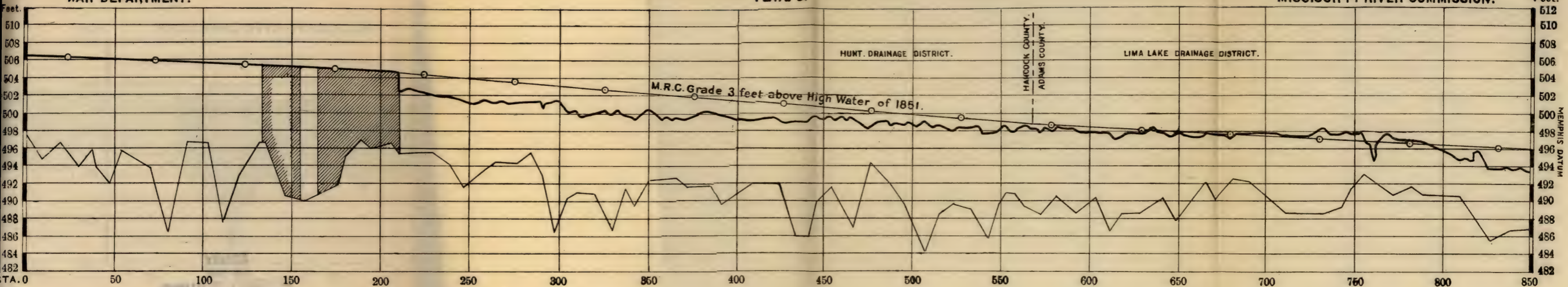


MISSISSIPPI RIVER COMMISSION  
NEW ORLEANS DISTRICT

WAR DEPARTMENT.

PLATE 5.

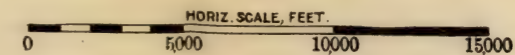
MISSISSIPPI RIVER COMMISSION.



LEGEND.

- Top of Levee. —————
- Established M.R.C. Grade. —○—○—○—
- Ground Line. —————
- Built by U.S. in 1917-18. [Shaded area]
- Enlarged by U.S. in 1917-18. [Hatched area]

LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.  
LEVEES IN HUNT AND LIMA LAKE DRAINAGE DISTRICTS  
LEFT BANK 363 TO 380 MILES ABOVE CAIRO.



Submitted:  
E. L. HARMAN  
Assistant Engineer.

To accompany my Annual Report for 1918:

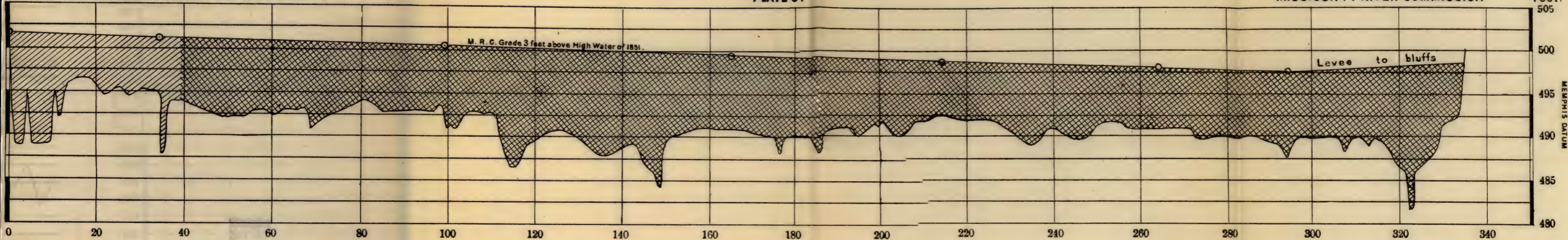
Drawn by H. d'A.  
June, 1918.

*E. J. Thomas*  
Assistant Engineer.  
Secretary, Mississippi River Commission.



WATER LEVEL RECORD  
 SHOWING THE VARIATION OF THE WATER LEVEL  
 DURING THE MONTH OF MAY 1960  
 AT THE STATION OF THE  
 U.S. ARMY CORPS OF ENGINEERS  
 AT THE STATION OF THE  
 U.S. ARMY CORPS OF ENGINEERS  
 AT THE STATION OF THE  
 U.S. ARMY CORPS OF ENGINEERS

100-120



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCKISLAND, ILL.

## GREGORY DRAINAGE DISTRICT LEVEE

RIGHT BANK 367 TO 374½ MILES ABOVE CAIRO.

## LEGEND.

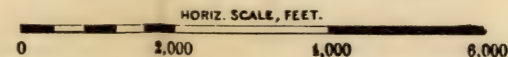
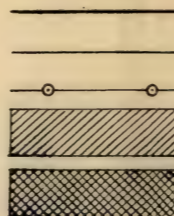
Top of Levee.

Ground Line.

Established M.R.C. Grade.

Built by U.S. in 1917-18.

Built by Local Authorities.



Submitted:

E. L. HARMAN

Assistant Engineer.

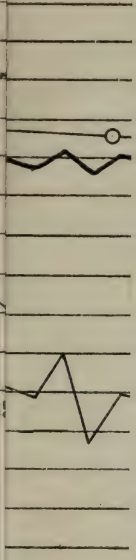
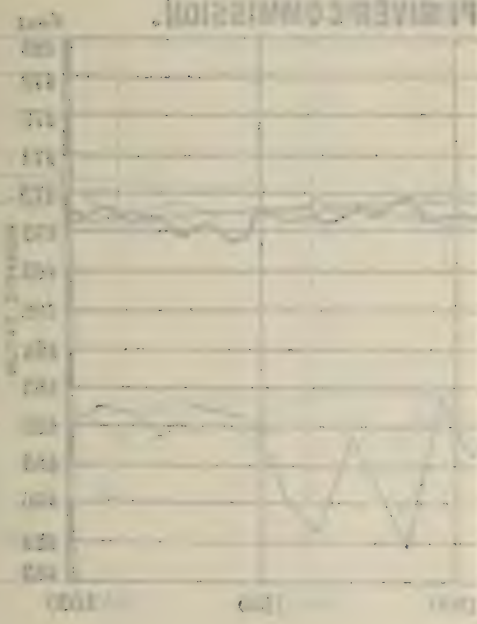
To accompany my Annual Report for 1918:

Drawn by H. d' A.

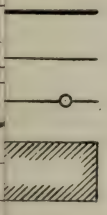
June, 1918.

*E. J. Thomas*  
Assistant Engineer.  
Secretary Mississippi River Commission.

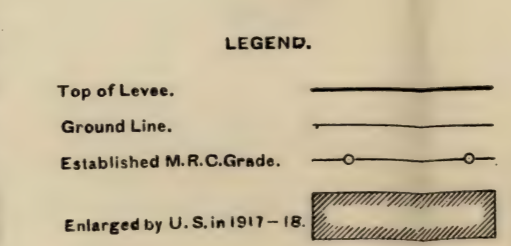
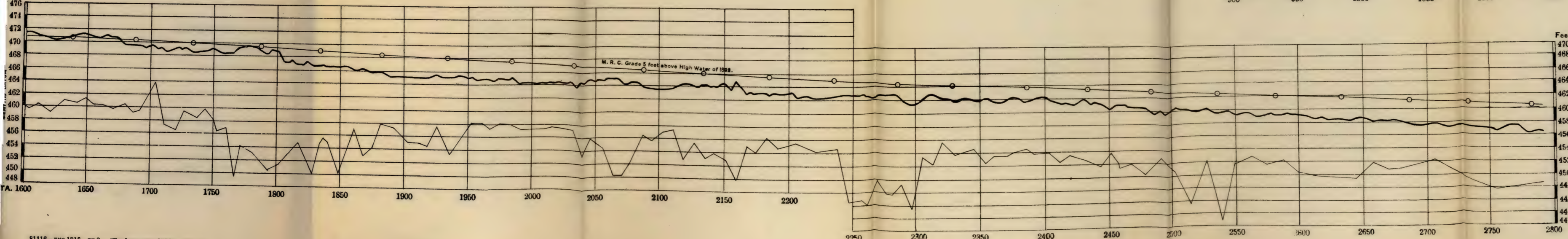
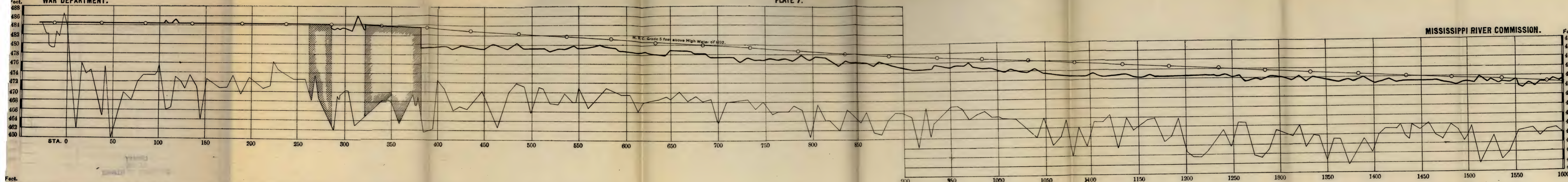
# PIRIVER COMMISSION



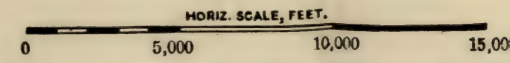
TO BE SUBMITTED TO THE PIRIVER COMMISSION  
 HIGH LEVEL



DATE: 10/10/10  
 BY: J. J. J. J.  
 FOR: PIRIVER COMMISSION



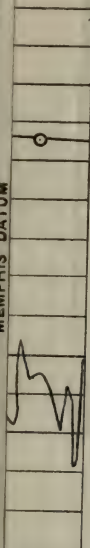
LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.  
**SNY LEVEE DRAINAGE DISTRICT LEVEE**  
 LEFT BANK 282 TO 335 MILES ABOVE CAIRO.



Submitted:  
**E. L. HARMAN**  
*Assistant Engineer.*

To accompany my Annual Report for 1918:  
*E. J. Thomas*  
*Assistant Engineer.*  
*Secretary, Mississippi River Commission.*

Drawn by H. d'A.  
 June, 1918.



MEMPHIS DATUM

MEMPHIS DATUM

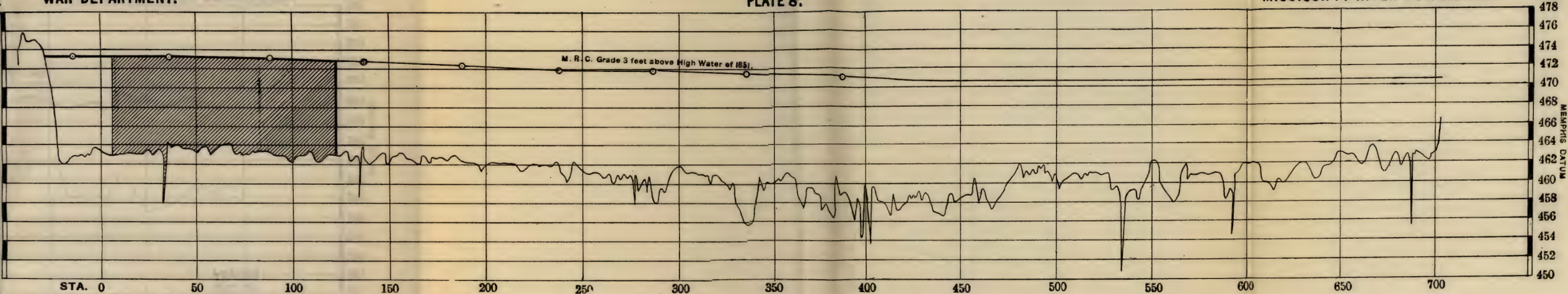
MEMPHIS DATUM

MEMPHIS DATUM

MEMPHIS DATUM

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MEMPHIS DATUM



## NOTES.

Levee between Sta. 0 and 305 is along Salt River.

Levee between Sta. 305 and 703 is along Mississippi River.

From Sta. 703 to 784 levee runs back to high ground near Ashburn, Mo.

## LEGEND.

Top of Levee.



Ground Line.



Established M.R.C. Grade.



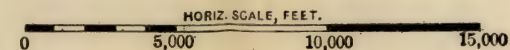
Built by U. S. in 1917-18.



LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.

RIVERLAND LEEVE DISTRICT LEEVE

RIGHT BANK 305 TO 312 MILES ABOVE CAIRO.



Submitted:

E. L. HARMAN

Assistant Engineer.

To accompany my Annual Report for 1918:

*E. J. Thomas*  
Assistant Engineer.

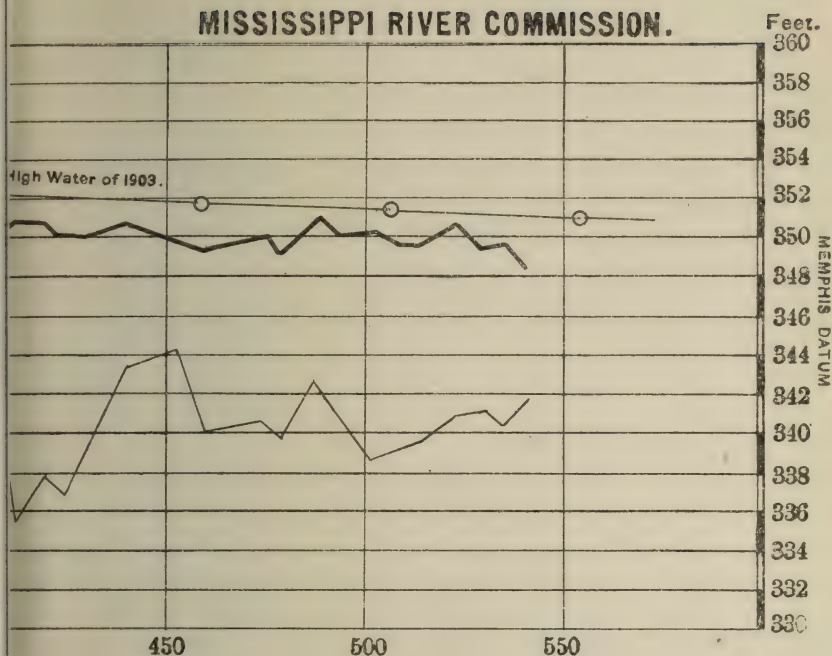
Secretary, Mississippi River Commission.

Drawn by H. d'A.

June, 1918.

M. R. C. Sheet 8.  
661

# MISSISSIPPI RIVER COMMISSION.



BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.  
 CAPE GIRARDEAU AND CLEAR CREEK LEVEE  
 FROM BANK 47 TO 60 MILES ABOVE CAIRO.

HORIZ. SCALE, FEET.

5,000 10,000 15,000

To accompany my Annual Report for 1918:

Engineer.

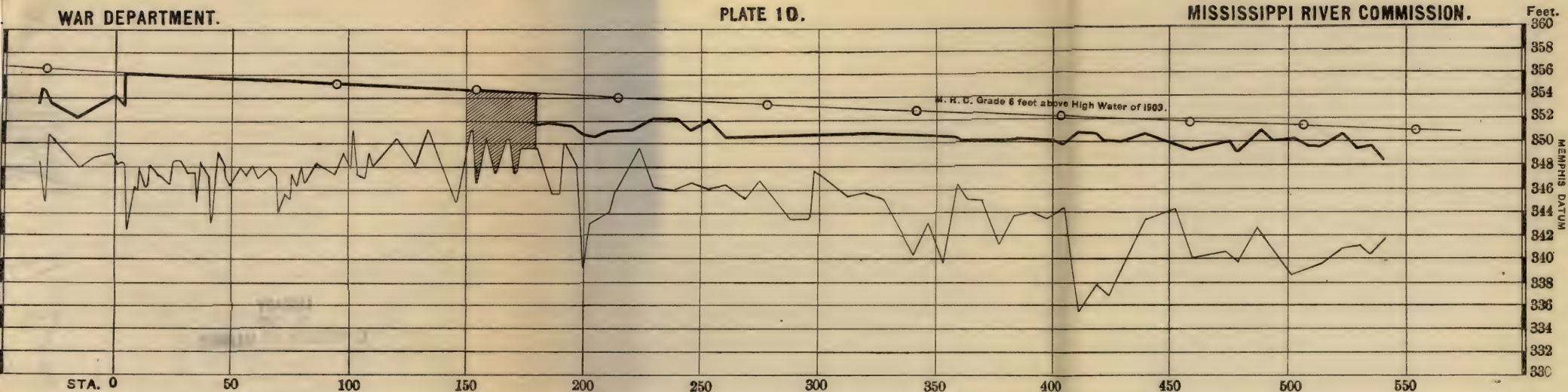
*E. J. Thomas*  
 Assistant Engineer.

Secretary, Mississippi River Commission.

WAR DEPARTMENT.

PLATE 10.

MISSISSIPPI RIVER COMMISSION.




LEGEND.

Top of Levee. —————

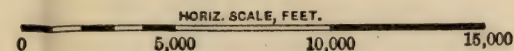
Established M.R.C. Grade. —○—○—

Ground Line. —————

Built by U.S. in 1917 - 18. 

LEVEES BETWEEN CAPE GIRARDEAU, MO. AND ROCK ISLAND, ILL.  
EAST CAPE GIRARDEAU AND CLEAR CREEK LEVEE

LEFT BANK 47 TO 60 MILES ABOVE CAIRO.



Submitted:

E. L. HARMAN

Assistant Engineer.

To accompany my Annual Report for 1918:

*E. J. Thomas*  
Assistant Engineer.

Secretary, Mississippi River Commission.

Drawn by H. d'A.

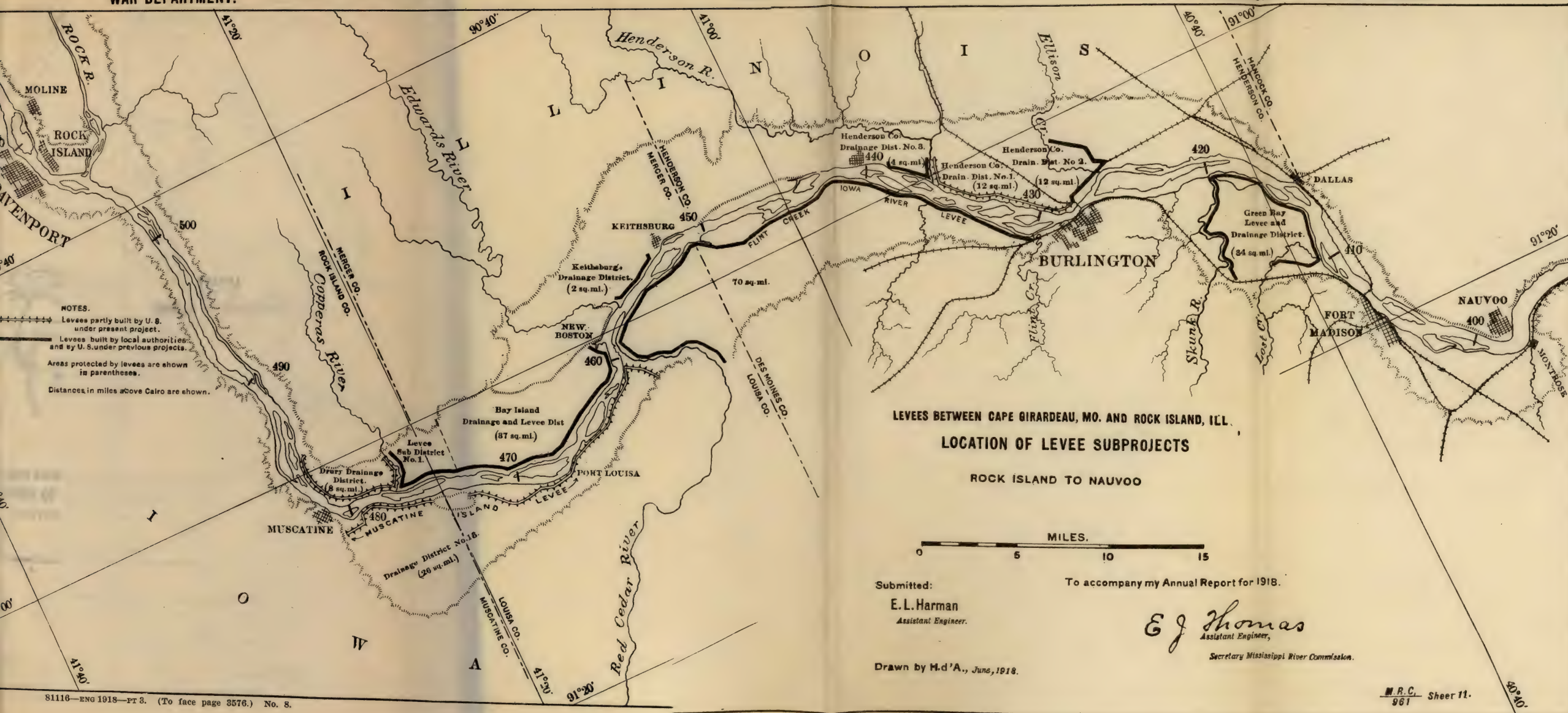
June, 1918.

M. R. C. Sheet 10.  
961

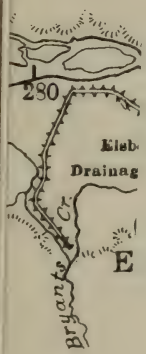


Su

Dr



39° 20'



CAPE GIRAR  
TION OF  
NAUVOC

5

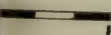


37°

Muddy

R

GREEN CAPE  
LOCATION  
AL



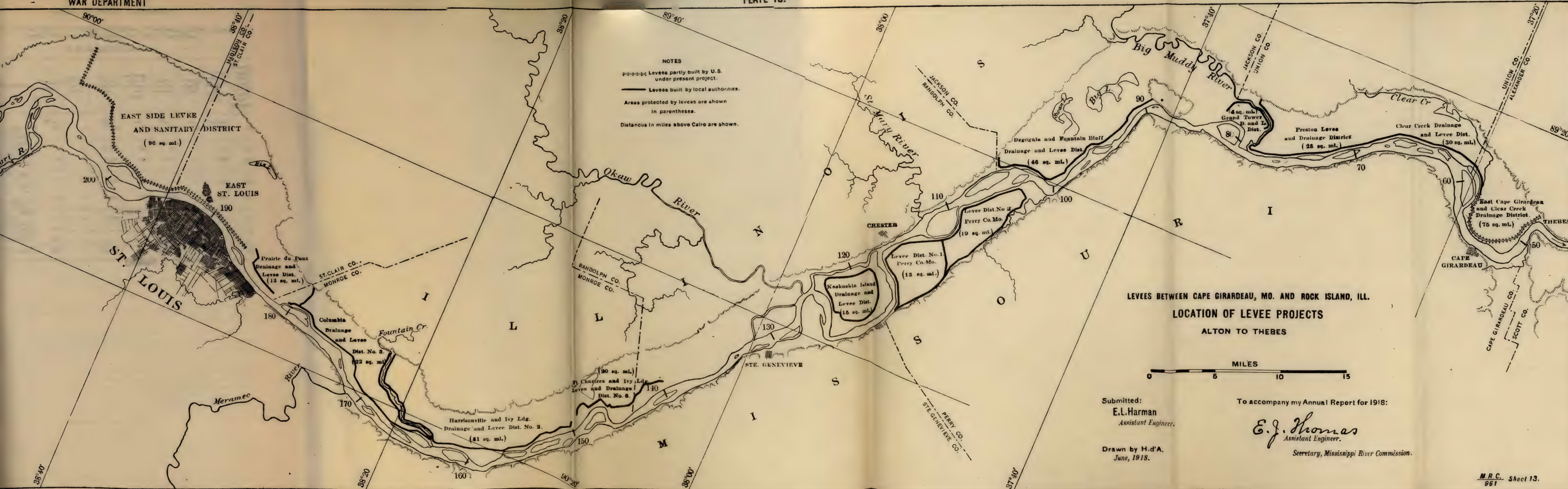


TABLE No. 7.—*Summary of dredging operations, Mississippi River below Cairo, during the low-water season of 1917—Continued.*

B. M. HARROD—Continued.

| Points of operation.  | Distance towed. | Number of cuts. | Total length of cuts. | Average rate of advance per hour. | Depth suction lowered. | Average depth of cut. | Average steam pressure per square inch. | Average speed main pump, revolutions per minute. |
|-----------------------|-----------------|-----------------|-----------------------|-----------------------------------|------------------------|-----------------------|-----------------------------------------|--------------------------------------------------|
|                       | <i>Miles.</i>   |                 | <i>Feet.</i>          | <i>Feet.</i>                      | <i>Feet.</i>           | <i>Feet.</i>          | <i>Pounds.</i>                          |                                                  |
| oso (104), Aug. 12-20 | 128             | 4               | 7,600                 | 271                               | 18                     | 7.1                   | 138                                     | 134                                              |
| thersville (110), ly- | 6               |                 |                       |                                   |                        |                       |                                         |                                                  |
| g up, Aug. 2-Sept. 5. |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| oso (104), second     |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| ae, Sept. 5-16.....   | 18              | 13              | 12,900                | 255                               | 16                     | 8.1                   | 132                                     | 136                                              |
| t Pleasant (80),      |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| pt. 16-22.....        | 24              | 9               | 9,900                 | 194                               | 14-16                  | 6.4                   | 128                                     | 126                                              |
| thersville (110),     |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| pt. 22-30.....        | 24              |                 |                       |                                   |                        |                       |                                         |                                                  |
| issons (70), Sept.    |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| -Oct. 6.....          | 40              | 11              | 16,350                | 199                               | 16                     | 4.3                   | 122                                     | 132                                              |
| t Pleasant (80),      |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| ond time, Oct.        |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| 7.....                | 10              | 11              | 18,500                | 207                               | 15-16                  | 4.8                   | 128                                     | 134                                              |
| thersville (110), ly- |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| g up, Oct. 17-22..... | 30              |                 |                       |                                   |                        |                       |                                         |                                                  |
| oso (104), third      |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| ae, Oct. 22-25.....   | 6               | 10              | 8,850                 | 225                               | 15                     | 5.0                   | 131                                     | 134                                              |
| thersville (110), ly- |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| g up, Oct. 25-Dec. 26 | 118             |                 |                       |                                   |                        |                       |                                         |                                                  |
| g into winter         |                 |                 |                       |                                   |                        |                       |                                         |                                                  |
| arters Dec. 26-28...  | 122             |                 |                       |                                   |                        |                       |                                         |                                                  |
| Total and average.    | 526             | 58              | 74,100                | 218                               | 14-18                  | 5.7                   | 130                                     | 133                                              |

## APPENDIX 1 A.

LAWS AFFECTING THE MISSISSIPPI RIVER COMMISSION, JULY 1, 1917,  
JUNE 30, 1918.

[Public—No. 37—65th Congress.]

[H. R. 4285.]

AN ACT Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

\* \* \* \* \*

The Mississippi River Commission shall forthwith make an examination of the Memphis Harbor, on the Mississippi River at the mouth of Wolf River, and at the earliest practicable moment make such plans and take such steps, to be approved by the Chief of Engineers, as will remove the large sand bar in front of Memphis to such an extent as may be necessary in the interest of navigation at that point, such improvements to be paid out of any funds heretofore or hereafter appropriated for the work of the Mississippi River Commission, not to exceed, however, the sum of \$250,000 for the current fiscal year.

\* \* \* \* \*

SEC. 13. That amounts hereafter paid by private parties or other agencies for rental of plant owned by the Government in connection with the prosecution of river and harbor works shall be deposited in each case to the credit of the appropriation to which the plant belongs.

Approved, August 8, 1917.

## LAWS AFFECTING THE MISSISSIPPI RIVER COMMISSION SINCE JULY 1, 1917

[Public—No. 181—65th Congress.]

[H. R. 12441.]

AN ACT Making appropriations for sundry civil expenses of the Government for fiscal year ending June thirtieth, nineteen hundred and nineteen, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the following sums are appropriated, out of any money in the Treasury not otherwise appropriated, for fiscal year ending June thirtieth, nineteen hundred and nineteen, namely:

\* \* \* \* \*

FLOOD CONTROL: For prosecuting work of flood control in accordance with provisions of the flood-control Act approved March first, nineteen hundred and seventeen, as follows:

Mississippi River, \$6,670,000.

Approved, July 1, 1918.

[Public—No. 200—65th Congress.]

[H. R. 10069.]

AN ACT Making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

\* \* \* \* \*

SEC. 4. That no part of the funds herein or hereafter appropriated for work of river and harbor improvement shall be used to pay for any work done under private contract if the contract price is more than twenty-five per centum in excess of the estimated cost of doing the work by Government plant: *Provided*, That in estimating the cost of doing the work by Government plant, includ

the cost of labor and materials, there shall also be taken into account proper charges for depreciation of plant and all supervising and overhead expenses and interest on the capital invested in the Government plant, but the rate of interest shall not exceed the maximum prevailing rate being paid by the United States on current issues of bonds or other evidences of indebtedness.

SEC. 5. That whenever the Secretary of War, in pursuance of authority conferred on him by law, causes proceedings to be instituted in the name of the United States for the acquirement by condemnation of any lands, easements, or rights of way needed for a work of river and harbor improvement duly authorized by Congress, the United States, upon the filing of the petition in any such proceedings, shall have the right to take immediate possession of said lands, easements, or rights of way, to the extent of the interest to be acquired, and proceed with such public works thereon as have been authorized by Congress: *Provided*, That certain and adequate provision shall have been made for the payment of just compensation to the party or parties entitled thereto, either by previous appropriation by the United States or by the deposit of moneys or other form of security in such amount and form as shall be approved by the court in which such proceedings shall be instituted. The respondent or respondents may move at any time in the court to increase or change the amounts or securities, and the court shall make such order as shall be just in the premises and as shall adequately protect the respondents. In every case the proceedings in condemnation shall be diligently prosecuted on the part of the United States in order that such compensation may be promptly ascertained and paid.

SEC. 6. That in all cases where private property shall be taken by the United States for the public use in connection with any improvement of rivers, harbors, canals, or waterways of the United States, and in all condemnation proceedings by the United States to acquire lands or easements for such improvements, where a part only of any such parcel, lot, or tract of land shall be taken, the jury or other tribunal awarding the just compensation or assessing the damages to the owner, whether for the value of the part taken or for any injury to the part not taken, shall take into consideration by way of reducing the amount of compensation or damages any special and direct benefits to the remainder arising from the improvement, and shall render their award or verdict accordingly.

SEC. 7. That hereafter the Chief of Engineers, United States Army, shall dictate in his annual reports the character of the terminal and transfer facilities existing on every harbor or waterway under maintenance or improvement by the United States, and state whether they are considered adequate for existing commerce. He shall also submit one or more special reports on this subject, as soon as possible, including, among other things, the following:

(a) A brief description of such water terminals, including location and the suitability of such terminals to the existing traffic conditions, and whether such terminals are publicly or privately owned, and the terms and conditions under which they may be subjected to public use.

(b) Whether such water terminals are connected by a belt or spur line of railroad with all the railroads serving the same territory or municipality, and whether such connecting railroad is owned by the public and the conditions upon which the same may be used, and also whether there is an interchange of traffic between the water carriers and the railroad or railroads as to such traffic which is carried partly by rail and partly by water to its destination, and also whether improved and adequate highways have been constructed connecting such water terminal with the other lines of highways.

(c) If no water terminals have been constructed by the municipality or other existing public agency there shall be included in his report an expression of opinion in general terms as to the necessity, number, and appropriate location of such a terminal or terminals.

(d) An investigation of the general subject of water terminals, with descriptions and general plans of terminals of appropriate types and construction for the harbors and waterways of the United States suitable for various commercial purposes and adapted to the varying conditions of tides, floods, and other physical characteristics.

SEC. 8. That if the Secretary of War shall determine that any of the contracts for work of river and harbor improvements entered into but not completed prior to April sixth, nineteen hundred and seventeen, the date of the entrance of the United States into the war with Germany, have become inequitable and unjust on account of increased costs of materials and labor and other unforeseen conditions arising out of the war, he is hereby authorized,

in his discretion and with the consent of the contractors, to modify and readjust the terms of said contracts in such manner as he may deem equitable and just. *Provided*, That such modifications and readjustments shall apply only to work under said contracts remaining to be done hereafter and shall not include an relief for work performed heretofore under said contracts, and any such sum as may be necessary to provide for the increased cost of the contracts due to said modifications and readjustments, not exceeding the sum of \$2,000,000, hereby appropriated out of any money in the Treasury not otherwise appropriated: *Provided further*, That as a condition of any such contract be so modified, the Secretary of War shall have the right, at the end of any fiscal year until the contract is completed, to make such further modifications as in his judgment shall be advantageous to the United States and just to the contractor.

SEC. 9. That hereafter when the expenses of persons engaged in field work or traveling on official business outside of the District of Columbia and away from their designated posts of duty are chargeable to appropriations of the Engineer Department, a per diem of not exceeding \$4 may be allowed in lieu of subsistence when not otherwise fixed by law.

Approved, July 18, 1918.

## APPENDIX 2.

### IMPROVING MISSISSIPPI RIVER, FIRST AND SECOND DISTRICTS.

The first district extends from Cape Girardeau, Mo., to the foot of Island 4 a distance of 270 miles. The second district extends from foot of Island 4 to the mouth of White River, a distance of 173 miles.

District headquarters: Memphis, Tenn.

District officer: Lieut. Col. G. P. Howell, Corps of Engineers, until November 9, 1917. Montgomery Gardner, assistant engineer in charge, since November 10, 1917.

President, Mississippi River Commission: Col. James G. Warren, Corps of Engineers, United States Army, acting president, to July 10, 1917. Brig. Gen. W. H. Bixby, United States Army, acting president, July 10-18, 1917; president since.

#### WORKS.

#### I. Revetments:

- (a) Columbus, Ky.
- (b) Hickman, Ky.
- (c) Slough Landing Neck, Tenn.
- (d) New Madrid, Mo.
- (e) Gayoso Bend, Mo.
- (f) Caruthersville, Mo.
- (g) Barfield, Ark.
- (h) Plum Point Reach, Ark. and Tenn.
- (i) Golden Lake, Ark.
- (j) Hopefield Bend, Ark.
- (k) Memphis Harbor, Tenn.
- (l) Norfolk, Miss.
- (m) Star Landing, Miss.
- (n) Porter Lake, Ark.
- (o) Walnut Bend, Ark.

(p) Trotters, Miss.

(q) Helena, Ark.

(r) Delta, Miss.

(s) Oldtown, Ark.

(t) Sunflower, Miss.

#### II. Experimental revetment.

#### III. Wolf River.

#### IV. Levees:

- (a) Upper St. Francis district.
- (b) Reelfoot district.
- (c) Lower St. Francis district.
- (d) Upper Yazoo district.
- (e) White River district.

#### V. Surveys.

#### VI. Plant.

(a) Columbus, Ky.

*Location and description.*—Twenty-one miles below Cairo, left bank.

*Original condition.*—For some years prior to 1890 the river bank in front of Columbus was subjected to more or less active caving, finally resulting in the necessity of fixing the channel and of preventing further encroachment upon the town, whose river front property was already in close proximity to the bank.

*Previous projects.*—None.

*Existing project.*—The existing project was adopted in 1889 and contemplated the installation of submerged revetment dikes along the Columbus front.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—All dikes are in effective condition and suggest no probable need of further expenditure.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The river channel in the vicinity of Columbus has been fixed and the town protected from its further encroachments. The bank between dikes and for some distance below has been maintained.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(b) *Hickman, Ky.*

*Location and description.*—Thirty-six miles below Cairo, left bank.

*Original condition.*—Throughout the eighties active caving was in progress along the Hickman river front, to the extent that in the year 1889 it became necessary to initiate revetment for the maintenance of the Hickman Harbor and for the protection of its river front property.

*Previous projects.*—None.

*Existing project.*—The existing project, adopted in 1889, provided for the revetment of the caving bank, to the end of holding the river channel in its then position and of preventing threatened destruction of town property.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—The revetment throughout is in good condition. No change of any consequence has occurred since last report.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The town of Hickman has been guarded against serious property loss; its river slope has been made stable, and the channel in front of the town has been permanently located.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(c) *Slough Landing Neck, Tenn.*

*Location and description.*—Sixty-eight to eighty miles below Cairo, left bank.

*Original condition.*—This is a long narrow point of land around which the Mississippi River flows, making acute bends on the upper and lower sides. Active bank caving had been in progress in both bends for a number of years, resulting in a progressive diminution of the distance across the neck. Moreover, incident to the extreme floods of 1912 and 1913, marked surface scour developed from rapid crossflow, thereby bringing into question a serious hazard of cut-off, the effect of which would be a disturbance of river conditions over a period of years and for many miles above and below the neck.

*Previous projects.*—None.

*Existing project.*—The existing project was adopted in 1913 to eliminate the danger of cut-off, by the revetment of the bends to prevent further bank loss and by the construction of a levee or dike along the neck to check crossflow and surface scour during the higher river stages.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—About 80 per cent of the revetment required on the upper side of the neck is completed. The work is in excellent condition with the exception of a few breaks in the bank pavement. Bank caving has definitely ceased throughout the length of bend where caving was most active. Caving, however, is in progress from the downstream end of the work for a distance of about 4,000 feet.

The levee, or dike, longitudinal of the neck, has effectively eliminated the question of crossflow and consequent surface scour.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The heretofore caving bend has been stabilized. The point of the confronting reef has moved downstream correspondingly. In conjunction with the levee or dike, constructed throughout the length of the neck, the threatened cut-off of the river, across the latter, has been obviated.

*Proposed operations.*—Extension, downstream, for a distance of about 4,000 feet will probably have to be made during the next two or three years unless the caving ceases or decreases materially in rate.

The necessity, or the contrary, for revetment on the lower side of the neck will depend wholly upon the further development of river conditions in the vicinity. Present indications point strongly to the probability that the main draw of the river will leave the caving bend, and that its revetment will therefore not be required.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River

(d) *New Madrid, Mo.*

*Location and description.*—Seventy-one miles below Cairo, right bank.

*Original condition.*—New Madrid is located at the head of a sharp bend of the river, opposite Watsons Point or Slough Landing Neck. The bank in front of the town had eroded for a number of years, to the point that in 1893 it was determined to be necessary to install revetment in order to fix the curvature of the river in this vicinity, and to guard the town against its further inroads.

*Previous projects.*—None.

*Existing project.*—The existing project, dating from 1893, had in view the construction of a sufficient length of standard fascine revetment to stabilize river and bank conditions along the New Madrid front.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—The entire work is in excellent condition.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The curvature of the stream throughout the New Madrid bend has been fixed, the front of the town made secure, and the destruction of its river front property prevented.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River

(e) *Gayoso Bend, Mo.*

*Location and description.*—One hundred and six miles below Cairo, right bank.

*Original condition.*—Caving in Gayoso Bend has been quite active for a number of years, and had progressed until the river bank was in such dangerous proximity to the controlling levee line that the United States constructed a levee loop around the most threatened point in 1914. This loop was extended downstream by the local levee board during 1915-16. A further retirement of the levee was deemed inadvisable on account of low and swampy country behind the existing levee which would render levee construction unduly costly; hence, protection by revetment was authorized at the joint cost of the Federal Government and local levee district.

*Previous projects.*—None.

*Existing project.*—Adopted in 1916; contemplates the protection of the levee in this bend by the installation of standard fascine revetment.

*Operations and results during the fiscal year.*—Operations consisted in the stalling of 2,200 feet of standard fascine channel mattress. Paving along is stretch, however, has not been completed. Work was in progress at the ne that the last annual report was submitted but was suspended on June 3, 17, on account of the high stage of the river. Operations were resumed on ly 10, 1917, and continued until December 7, 1917, when the outfit was moved Osceola, Ark.

The foregoing operations were accomplished by hired labor with Govern-ent plant, at a total cost of \$145,875.85.

The following table gives detailed costs:

GAYOSO BEND, MO. (106 R.), FIRST AND SECOND DISTRICTS.

*attresses, total area 5,784 squares (channel mats, 7½ per cent; connecting mats, 26 per cent).*

BUILDING MATS.

| Items.                              | Quantity used.  |             | Per square.    |         |
|-------------------------------------|-----------------|-------------|----------------|---------|
|                                     | Total quantity. | Total cost. | Quan-<br>tity. | Cost.   |
| obilization and demobilization..... |                 | \$175.00    |                | \$0.030 |
| nch strand.....pounds..             | 20,050          | 1,768.78    | 3.467          | .306    |
| nch strand.....do..                 | 12,215          | 876.24      | 2.115          | .151    |
| nch strand.....do..                 | 37,300          | 2,387.20    | 6.450          | .412    |
| ire, No. 9.....do..                 | 14,800          | 558.32      | 2.559          | .096    |
| ire, silicon br.....do..            | 650             | 133.25      | .112           | .023    |
| aples.....do..                      | 1,400           | 44.10       | .242           | .008    |
| ps, ½ inch.....number..             | 2,031           | 227.48      | .351           | .039    |
| ps, ¾ inch.....do..                 | 2,203           | 140.33      | .381           | .024    |
| ush and poles.....cord..            | 7,154.2         | 13,692.98   | 1.238          | 2.368   |
| pe, manila.....pounds..             | 5,413           | 1,586.01    | .936           | .274    |
| scellaneous expenses.....           |                 | 339.74      |                | .059    |
| bsistence.....                      |                 | 11,755.59   |                | 2.053   |
| amboat expenses.....                |                 | 6,312.13    |                | 1.096   |
| bor.....                            |                 | 15,121.91   |                | 2.655   |
| pervision.....                      |                 | 3,690.65    |                | .635    |
| Total.....                          |                 | 58,809.71   |                | 10.169  |
| Total field cost.....               |                 | 58,809.71   |                | 10.169  |

BALLASTING AND SINKING.

|                                     |       |           |       |         |
|-------------------------------------|-------|-----------|-------|---------|
| obilization and demobilization..... |       | \$60.00   |       | \$0.013 |
| one.....tons..                      | 3,898 | 8,887.44  | 0.674 | 1.537   |
| pe, manila.....pounds..             | 1,864 | 546.21    | .322  | .094    |
| scellaneous expenses.....           |       | 84.96     |       | .015    |
| bsistence.....                      |       | 3,001.00  |       | .518    |
| amboat expenses.....                |       | 985.25    |       | .170    |
| bor.....                            |       | 3,582.37  |       | .618    |
| pervision.....                      |       | 768.90    |       | .133    |
| Total.....                          |       | 17,916.13 |       | 3.098   |
| Total field cost.....               |       | 17,916.13 |       | 3.098   |

## Grading, 2,196 squares.

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$60.00     |             | \$0.00 |
| Rope, manila.....pounds..            | 1,835           | 537.65      | 0.836       | .2     |
| Coal.....tons..                      | 285             | 1,140.00    | .130        | .5     |
| Oil.....                             |                 | 26.40       |             | .0     |
| Miscellaneous expenses.....          |                 | 224.02      |             | .1     |
| Subsistence.....                     |                 | 1,477.70    |             | .6     |
| Steamboat expenses.....              |                 | 545.03      |             | .2     |
| Labor.....                           |                 | 2,308.44    |             | 1.0    |
| Supervision.....                     |                 | 457.66      |             | .2     |
| Total.....                           |                 | 6,776.90    |             | 3.0    |
| Total field cost.....                |                 | 6,776.90    |             | 3.0    |

## Paving.

| Items.                               | Stone (1,507 squares). |             |             |         | Concrete (557 squares). |             |             |        |
|--------------------------------------|------------------------|-------------|-------------|---------|-------------------------|-------------|-------------|--------|
|                                      | Quantity used.         |             | Per square. |         | Quantity used.          |             | Per square. |        |
|                                      | Total quantity.        | Total cost. | Quantity.   | Cost.   | Total quantity.         | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                        | \$85.00     |             | \$0.056 |                         | \$50.00     |             | \$0.00 |
| Stone.....tons..                     | 4,250                  | 9,690.00    | 2.820       | 6.430   |                         |             |             |        |
| Rope, manila.....pounds..            | 3,592                  | 1,054.46    | 2.383       | .700    | 1,796                   | 526.23      | 3.224       | .94    |
| Cement.....sacks.....                |                        |             |             |         | 2,114                   | 1,183.84    | 3.795       | 2.19   |
| Sand and gravel.....cubic yards      |                        |             |             |         | 650                     | 436.50      | 1.167       | .78    |
| Coal.....tons..                      |                        |             |             |         | 22                      | 88.00       | .039        | .18    |
| Miscellaneous expenses.....          |                        | 124.49      |             | .083    |                         | 11.87       |             | .02    |
| Subsistence.....                     |                        | 5,661.04    |             | 3.756   |                         | 1,901.22    |             | 3.41   |
| Steamboat expenses.....              |                        | 2,196.37    |             | 1.457   |                         | 561.74      |             | 1.01   |
| Labor.....                           |                        | 6,715.04    |             | 4.456   |                         | 1,001.30    |             | 1.79   |
| Supervision.....                     |                        | 1,620.32    |             | 1.076   |                         | 524.00      |             | .94    |
| Total.....                           |                        | 27,146.72   |             | 18.013  |                         | 6,284.70    |             | 11.30  |
| Total field cost.....                |                        | 27,146.72   |             | 18.013  |                         | 6,284.70    |             | 11.30  |

## Summary of costs (2,200 linear feet revetted).

|                            | Subaqueous work. |             | Upper bank work. |             | Grand total. <sup>1</sup> |
|----------------------------|------------------|-------------|------------------|-------------|---------------------------|
|                            | Per square.      | Total.      | Per square.      | Total.      |                           |
| Total field cost.....      | \$13.267         | \$76,725.84 | \$17.747         | \$40,208.32 | \$116,934.1               |
| Office expenses.....       | .238             | 1,371.13    | .312             | 706.34      | 2,077.4                   |
| Surveys.....               | .070             | 399.11      | .090             | 205.61      | 604.7                     |
| Care of plant.....         | .595             | 3,441.54    | .782             | 1,772.92    | 5,214.4                   |
| Repair of plant.....       | .518             | 2,997.01    | .681             | 1,543.91    | 4,540.9                   |
| Depreciation of plant..... | 1.884            | 10,892.72   | 2.476            | 5,611.40    | 16,504.1                  |
| Total.....                 | 16.572           | 95,827.35   | 22.088           | 50,048.50   | 145,875.8                 |

<sup>1</sup> Total cost per linear foot can not be given on account of bank paving not being completed.

*Condition at the end of fiscal year.*—Caving continues upstream from the upper end of the revetment; however, the margin between the river bank and the levee is of such width that the levee will not be endangered for some years to come. The work, nevertheless, should be extended upstream at some time in the future in order to fully protect the levee in this bend.

*Local cooperation.*—The St. Francis Levee Board of Missouri contributed 50,000 toward the cost of this work.

*Terminal facilities.*—None.

*Effect of improvement.*—The revetment placed has resulted in stabilizing of a river bank and the protection of the levee.

*Proposed operations.*—Completion of upper bank paving along this year's work with the available balance.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(f) *Caruthersville, Mo.*

*Location and description.*—One hundred and ten miles below Cairo, right bank.

*Original condition.*—Prior to 1898 the river in this vicinity had approached the town of Caruthersville, to the point of requiring that the town front be vetted as the alternative to the serious destruction of its property and levee. It was desirable as well to hold this point as an assistance in fixing the banks, both above and below, where, for some distance, the controlling levee was quite close to the river.

*Previous projects.*—None.

*Existing project.*—The existing project provided for the holding of the Caruthersville point in the interest of channel and bank conditions in the locality, and dates from the year 1898. It contemplated the construction of a cur dike and sufficient fascine revetment to effect the purpose outlined.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—The work is in excellent condition throughout.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The improvement has resulted in the prevention of further bank erosion, in the fixing of river conditions in the vicinity, and in guarding the town of Caruthersville and adjacent levees from serious destruction.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(g) *Barfield, Ark.*

*Location and description.*—One hundred and forty-one miles below Cairo, right bank.

*Original condition.*—Caving has been very active from River Styx to Barfield Landing; at the latter point the controlling levee was breached. The topographical features of the country adjacent to the levee were such that to build the levee on a location sufficiently remote from the caving bank to insure anything like a reasonable length of life, would be unduly expensive; therefore, protection by the installation of bank revetment was authorized with the understanding that the local levee board would construct a levee loop around the breach in the levee at Barfield Landing, Ark.

*Previous projects.*—None.

*Existing project.*—Adopted in 1916; contemplates the protection of the levee in this vicinity by the installation of standard revetment.

*Operations and results during the fiscal year.*—Operations consisted in the installation of 2,822 feet of standard fascine channel mattress. Grading and paving along this stretch, however, has not been fully completed. Work was in progress at the time that the last annual report was submitted, but was suspended on June 7, 1917, on account of the high stage of the river; operations were resumed on August 1, 1917, and continued until December 13, 1917, when the outfit was moved to a safe ice harbor on account of heavy running water, and later towed to Memphis on February 15, 1918.

The foregoing operations were accomplished by hired labor with Government plant at a total cost of \$161,936.35.

The following table gives detailed costs:

BARFIELD, ARK. (141 R), FIRST AND SECOND DISTRICTS.

*Mattresses, total area 8,608 squares (channel mats., 95 per cent; connectin  
mats., 5 per cent).*

#### BUILDING MATS.

| Items.                                  | Quantity used.  |             | Per square.    |        |
|-----------------------------------------|-----------------|-------------|----------------|--------|
|                                         | Total quantity. | Total cost. | Quan-<br>tity. | Cost.  |
| Mobilization and demobilization.....    |                 | \$380.00    |                | \$0.00 |
| $\frac{3}{4}$ -inch strand.....pounds.. | 51,300          | 3,546.59    | 5.960          | .4     |
| $\frac{1}{2}$ -inch strand.....do.....  | 21,374          | 1,169.16    | 2.482          | .1     |
| $\frac{3}{4}$ -inch strand.....do.....  | 30,374          | 3,863.94    | 3.529          | .4     |
| Wire, No. 9.....do.....                 | 19,800          | 940.10      | 2.300          | .1     |
| Wire, silicon bronze.....do.....        | 950             | 225.00      | .111           | .0     |
| Staples.....do.....                     | 1,950           | 61.43       | .226           | .0     |
| Clips, $\frac{1}{2}$ -inch.....number.. | 3,040           | 376.30      | .353           | .0     |
| Clips, $\frac{3}{8}$ -inch.....do.....  | 2,700           | 171.99      | .312           | .0     |
| Brush and poles.....cord..              | 10,707.6        | 18,738.31   | 1.244          | 2.1    |
| Rope, manila.....pounds..               | 6,520           | 1,910.36    | .758           | .2     |
| Miscellaneous expenses.....             |                 | 474.65      |                | .0     |
| Subsistence.....                        |                 | 10,897.25   |                | 1.2    |
| Steamboat expenses.....                 |                 | 8,901.02    |                | 1.0    |
| Labor.....                              |                 | 15,986.28   |                | 1.8    |
| Supervision.....                        |                 | 4,843.97    |                | .5     |
| Total.....                              |                 | 72,486.35   |                | 8.4    |
| Total field cost.....                   |                 | 72,486.35   |                | 8.4    |

#### BALLASTING AND SINKING.

|                                      |         |           |       |        |
|--------------------------------------|---------|-----------|-------|--------|
| Mobilization and demobilization..... |         | \$110.00  |       | \$0.00 |
| Stone.....tons..                     | 5,146.4 | 11,733.79 | 0.598 | 1.3    |
| Rope, manila.....pounds..            | 2,468   | 723.12    | .287  | .0     |
| Miscellaneous expenses.....          |         | 177.00    |       | .0     |
| Subsistence.....                     |         | 2,345.86  |       | .2     |
| Steamboat expenses.....              |         | 1,202.30  |       | .1     |
| Labor.....                           |         | 3,844.00  |       | .4     |
| Supervision.....                     |         | 867.50    |       | .1     |
| Total.....                           |         | 21,003.57 |       | 2.4    |
| Total field cost.....                |         | 21,003.57 |       | 2.4    |

#### Grading (3,248 squares).

| Items.                               | Quantity used.  |             | Per square.    |        |
|--------------------------------------|-----------------|-------------|----------------|--------|
|                                      | Total quantity. | Total cost. | Quan-<br>tity. | Cost.  |
| Mobilization and demobilization..... |                 | \$110.00    |                | \$0.00 |
| Rope, manila.....pounds..            | 1,787           | 523.59      | 0.550          | .1     |
| Coal.....tons..                      | 402             | 1,349.00    | .124           | .4     |
| Oil.....                             |                 | 39.10       |                | .0     |
| Miscellaneous expenses.....          |                 | 576.58      |                | .1     |
| Subsistence.....                     |                 | 2,091.10    |                | .6     |
| Steamboat expenses.....              |                 | 639.99      |                | .1     |
| Labor.....                           |                 | 4,278.68    |                | 1.3    |
| Supervision.....                     |                 | 601.31      |                | .1     |
| Total.....                           |                 | 10,209.35   |                | 3.1    |
| Total field cost.....                |                 | 10,209.35   |                | 3.1    |

*Paving (stone, 1,955 squares).*

| Items.                               | Quantity used.  |             | Per square. |          |
|--------------------------------------|-----------------|-------------|-------------|----------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.    |
| mobilization and demobilization..... |                 | \$73. 49    |             | \$0. 038 |
| le.....tons                          | 5,634. 6        | 12,846. 89  | 2. 882      | 6. 571   |
| le, manila.....pounds                | 4,225           | 1,237. 92   | 2. 161      | . 632    |
| cellaneous expenses.....             |                 | 188. 23     |             | . 095    |
| sistence.....                        |                 | 3,860. 67   |             | 1. 974   |
| unboat expenses.....                 |                 | 2,211. 34   |             | 1. 130   |
| or.....                              |                 | 5,966. 19   |             | 3. 056   |
| ervision.....                        |                 | 1,150. 61   |             | . 589    |
| Total.....                           |                 | 27,535. 34  |             | 14. 085  |
| Total field cost.....                |                 | 27,535. 34  |             | 14. 085  |

*Summary of costs (2,822 linear feet revetted).*

|                         | Subaqueous work. |              | Upper bank work. |              | Grand total. <sup>1</sup> |
|-------------------------|------------------|--------------|------------------|--------------|---------------------------|
|                         | Per square.      | Total.       | Per square.      | Total.       |                           |
| l field cost.....       | \$10. 860        | \$93,489. 92 | \$17. 228        | \$37,744. 69 | \$131,234. 61             |
| le expenses.....        | . 140            | 1,207. 58    | . 225            | 493. 23      | 1,700. 81                 |
| veys.....               | . 002            | 15. 60       | . 003            | 6. 38        | 21. 98                    |
| of plant.....           | . 473            | 4,072. 50    | . 759            | 1,663. 41    | 5,735. 91                 |
| air of plant.....       | . 395            | 3,392. 46    | . 731            | 1,602. 55    | 4,995. 01                 |
| reciation of plant..... | 1. 506           | 12,956. 10   | 2. 415           | 5,291. 93    | 18,248. 03                |
| Total.....              | 13. 376          | 115,134. 16  | 21. 361          | 46,802. 19   | 161,936. 35               |

<sup>1</sup> Total cost per linear foot can not be given on account of upper bank work not being completed.

*Condition at the end of fiscal year.*—Caving continues above, below, and in gap between the revetment. The revetted bank has been stabilized.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the revetment placed has resulted in protection of the levee where the caving bank was threatening same.

*Proposed operations.*—Completion of grading and paving along the stretch of bank installed during the present fiscal year, with the available balance. Placement of 3,000 feet of revetment in the gap, which will connect the two ends of revetment; and an upstream extension of 1,000 feet during the coming season when necessary funds become available; and a further extension both upstream and downstream of about 3,000 feet on each end as the funds therefor become available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of September 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*(h) Plum Point Reach, Ark. and Tenn.*

*Location and description.*—One hundred and forty-seven to 185 miles below Cairo.

*Original condition.*—In accordance with the first plans of the commission, construction operations were limited to two reaches of the river where navigational difficulties were the most pronounced. The upper one, known as Plum Point Reach, covered the river from the head of Island 26, 147 miles below Cairo, to Randolph, Tenn., a distance of 38 miles. In this reach channel depths of 4 to 6 feet were frequently reported. The early construction work was

limited to the stretch between Ashport, Tenn., 153 miles below Cairo, and Bullerton towhead, a distance of 15 miles.

The width of the river between the high water banks in this reach was largely in excess of the average, being 10,000 feet for much of its length, which resulted in shallow shifting channels.

*Previous project.*—To correct this condition, works were inaugurated in 1894 providing for contraction of the low water channel to a width of 3,000 feet. This to be accomplished by means of permeable pile dikes, the closure of chutes behind towheads and islands, and the revetment of caving banks.

The development of hydraulic dredges and their success in maintaining temporary channels of ample depth during the low water periods resulted, in 1895, in the suspension of channel contraction work, and since that date work has been confined to repairs to revetments.

*Existing project.*—Repairs to revetments.

*Operations and results during the fiscal year.*—The necessary plant and materials arrived at Osceola, Ark., on December 8, 1917, with which to extend upstream the Osceola revetment for the protection of the existing levee, but before any work could be accomplished operations were interrupted on account of abnormal weather conditions which resulted in the formation of an enormous ice gorge which did not go out until February 7, 1918. The breaking up of the ice gorge was followed by a rise in the river, preventing any work.

*Condition at the end of fiscal year.*—The revetment works throughout Plum Point Reach are generally in effective condition with the exception of that at the lower end of Ashport Bend, which was flanked some years since, and at the upper end of the Osceola revetment, where a deep pocket cave has occurred since the last report.

High water attack continues at the downstream end of the new Bullerton Bar revetment, where a pocket cave developed during the high water of 1917 resulting in the total loss of about 1,000 feet of the old work.

The stone and brush dam at the head of chute of Island 30 has been destroyed, as heretofore reported, for a width of 1,300 feet near its center and flanked around its western end.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The channel throughout Plum Point Reach has been rendered more stable and its depths materially increased. Bank caving has been prevented throughout the length of the several revetments and the Arkansas levee from Fletchers Bend to near Bullerton has been thus protected as have also the towns of Luxora and Osceola, Ark.

*Proposed operations.*—It is proposed to extend upstream the Osceola revetment 2,000 feet to cover the pocket cave referred to above.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

#### (i) Golden Lake, Ark.

*Location and description.*—One hundred and ninety-two miles below Cairo, right bank.

*Original condition.*—Caving had been in progress for many years prior to 1911. In the bend of Golden Lake the levee line had been located between the river and a large area of low marshy ground to the rear. Its relocation would, therefore, have been both difficult and costly. The river had attained such proximity to the said levee line by 1911 as to require that the river channel be stabilized and further caving be prevented by the installation of revetment.

*Previous projects.*—None.

*Existing project.*—Adopted in 1911; had in view the prevention by bank revetment of further erosion in order that the channel might be held in definite position, the existing levee line maintained, and the construction of a costly levee loop around Golden Lake obviated.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—The revetment is in good condition with the exception that a pocket cave has set up at its lower end with some loss of

per bank paving. This condition is of relatively small consequence for the present and no evidence exists that it will require any attention for several years.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—Bank caving throughout the length and in the vicinity of the revetment has been stopped and the existing levee line maintained, thereby avoiding the necessity and expense of a costly levee loop around Olden Lake. The channel has been held to position throughout the bend.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(j) *Hopefield Bend, Ark.*

*Location and description.*—Two hundred and twenty-seven miles below Cairo, right bank.

*Original condition.*—The old course of the river in this locality crossed from the Tennessee shore above Memphis in a long sweep to the Arkansas shore, hence by an acute bend back to the Tennessee shore in the vicinity of Memphis. This situation involved persistent and finally very active caving from about Mound City, Ark., downstream to Hopefield Point. It became evident about 1880 that continued loss of bank throughout the stretch of river in question would seriously damage, if not destroy, the important harbor of Memphis.

*Previous projects.*—None.

*Existing project.*—Adopted in 1882; contemplated the revetment of the bend between Hopefield and Mound City, to the extent necessary to hold the river in its then course, and to thus maintain the harbor of Memphis.

*Operations and results during the fiscal year.*—Operations consisted in the repairs to a small pocket cave about 1,500 feet above Hopefield Point and repairs to the concrete paving of the earthen dike. The necessary plant and material was assembled for this work on September 8, 1917, which was completed on October 22, 1917.

The foregoing operations were accomplished by hired labor with Government funds, at a total cost of \$11,390.46.

The following table gives detailed costs:

HOPEFIELD BEND, ARK. (227 R.), FIRST AND SECOND DISTRICTS.

*Mattresses, total area 180 squares (connecting mats, 100 per cent).*

BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Organization and demobilization..... |                 | \$47.20     |             | \$0.262 |
| 1/2 inch strand..... pounds..        | 250             | 17.38       | 1.390       | .096    |
| 1/2 inch strand..... do.....         | 630             | 45.05       | 3.500       | .250    |
| 1/2 inch strand..... do.....         | 1,035           | 78.97       | 5.750       | .439    |
| 7/8, No. 9..... pounds..             | 630             | 30.24       | 3.500       | .168    |
| 1/2 inch..... do.....                | 40              | 1.26        | .222        | .007    |
| 1/2 inch..... number.....            | 20              | 2.44        | .111        | .012    |
| 1/2 inch and poles..... cord..       | 286.4           | 501.20      | 1.480       | 2.785   |
| 1/2 inch, manila..... pounds..       | 578             | 179.18      | 3.211       | .995    |
| Collaneous expenses.....             |                 | 31.40       |             | .175    |
| Incidence.....                       |                 | 351.15      |             | 1.951   |
| Boat expenses.....                   |                 | 101.75      |             | .565    |
| Over.....                            |                 | 357.32      |             | 1.985   |
| Supervision.....                     |                 | 86.00       |             | .478    |
| Total.....                           |                 | 1,830.54    |             | 10.170  |
| Total field cost.....                |                 | 1,830.54    |             | 10.170  |

Mattresses, total area 180 squares (connecting mats, 100 per cent)—Continued

## BALLASTING AND SINKING.

| Items.                               | Quantity used.  |             | Per square |       |
|--------------------------------------|-----------------|-------------|------------|-------|
|                                      | Total quantity. | Total cost. | Quantity.  | Cost. |
| Mobilization and demobilization..... |                 | \$15.34     |            | \$0   |
| Stone..... tons.....                 | 140             | 319.20      | 0.778      | 1     |
| Rope, manila..... pounds.....        | 390             | 120.90      | 2.167      |       |
| Miscellaneous expenses.....          |                 | 15.59       |            |       |
| Subsistence.....                     |                 | 108.05      |            |       |
| Steamboat expenses.....              |                 | 33.07       |            |       |
| Labor.....                           |                 | 102.75      |            |       |
| Supervision.....                     |                 | 27.95       |            |       |
| Total.....                           |                 | 742.85      |            | 4     |
| Total field cost.....                |                 | 742.85      |            | 4     |

## Grading (195 squares).

| Items.                               | Quantity used.  |             | Per square |       |
|--------------------------------------|-----------------|-------------|------------|-------|
|                                      | Total quantity. | Total cost. | Quantity.  | Cost. |
| Mobilization and demobilization..... |                 | \$29.50     |            | \$0   |
| Miscellaneous expenses.....          |                 | 23.30       |            |       |
| Subsistence.....                     |                 | 187.67      |            |       |
| Steamboat expenses.....              |                 | 63.59       |            |       |
| Labor.....                           |                 | 185.80      |            |       |
| Supervision.....                     |                 | 53.75       |            |       |
| Total.....                           |                 | 543.61      |            | 2     |
| Total field cost.....                |                 | 543.61      |            | 2     |

## Paving.

| Items.                                | Stone (364 squares). |             |             |         | Concrete (99 squares). |             |             |         |
|---------------------------------------|----------------------|-------------|-------------|---------|------------------------|-------------|-------------|---------|
|                                       | Quantity used.       |             | Per square. |         | Quantity used.         |             | Per square. |         |
|                                       | Total quantity.      | Total cost. | Quantity.   | Cost.   | Total quantity.        | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization.....  |                      | \$85.24     |             | \$0.233 |                        | \$30.77     |             | \$0.310 |
| Stone..... tons.....                  | 1,100                | 2,508.00    | 3.022       | 6.890   |                        |             |             |         |
| Rope, manila..... pounds.....         | 289                  | 89.59       | .794        | .245    | 188                    | 58.28       | 1.899       |         |
| Cement..... sacks.....                |                      |             |             |         | 690                    | 317.40      | 6.970       |         |
| Sand and gravel..... cubic yards..... |                      |             |             |         | 120                    | 60.00       | 1.212       |         |
| Miscellaneous expenses.....           |                      | 11.46       |             | .032    |                        | 6.10        |             |         |
| Subsistence.....                      |                      | 758.16      |             | 2.083   |                        | 248.10      |             |         |
| Steamboat expenses.....               |                      | 55.97       |             | .153    |                        | 36.30       |             |         |
| Labor.....                            |                      | 735.85      |             | 2.022   |                        | 261.39      |             |         |
| Supervision.....                      |                      | 178.00      |             | .490    |                        | 98.40       |             |         |
| Total.....                            |                      | 4,422.27    |             | 12.148  |                        | 1,116.74    |             | 1       |
| Total field cost.....                 |                      | 4,422.27    |             | 12,148  |                        | 1,116.74    |             | 1       |

*Summary of costs.*

|                             | Subaqueous work. |            | Upper bank work. |            | Grand total. <sup>1</sup> |
|-----------------------------|------------------|------------|------------------|------------|---------------------------|
|                             | Per square.      | Total.     | Per square.      | Total.     |                           |
| Initial field cost. ....    | \$14.297         | \$2,573.39 | \$14.501         | \$6,082.62 | \$8,656.01                |
| Repair of plant. ....       | .840             | 151.22     | .893             | 370.23     | 521.45                    |
| Depreciation of plant. .... | .732             | 131.69     | .769             | 322.40     | 454.09                    |
| Appreciation of plant. .... | 2.833            | 510.08     | 2.987            | 1,248.83   | 1,758.91                  |
| Total. ....                 | 18.702           | 3,366.38   | 19.150           | 8,024.08   | 11,390.46                 |

All repair work, hence the cost per linear foot of bank protected can not be given.

*Condition at the end of fiscal year.*—The revetment generally throughout this bend is in excellent condition. There is, however, a small pocket cave about 800 feet above Hopefield Point which should be repaired during next season. Below the lower end of the revetment for a distance of about 1,200 feet some caving occurred during the rise of last February. This, however, does not need any immediate attention.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The bank and channel throughout Hopefield bend were fixed from the installation of the Hopefield work until 1912 when, as observed above, the river changed its course, breaking through between Hen and Chicken Islands. Any tendency or possibility of cut-off of the river by way of Hopefield Lake has been obviated and the harbor of the city of Memphis maintained.

*Proposed operations.*—Repairs to the small pocket cave referred to above are contemplated during the coming low water season.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*(k) Memphis Harbor, Tenn.*

*Location and description.*—Two hundred and thirty to two hundred and forty-two miles below Cairo, left bank.

*Original condition.*—The city of Memphis differs from most of the Mississippi River towns to the extent that it is not located on delta ground, but upon what have been known as the Chickasaw Bluffs. These bluffs being reasonably stable, the river front property of the town was constructed fairly close to the river bank. In the course of time, however, and during the early twenties, bank erosion set up and progressed to the point of endangering the town and its valuable river front improvements so that it became necessary to consider the installation of protective works such that the city could be guarded against property loss, its harbor maintained, and its river commerce assured.

*Previous projects.*—None.

*Existing project.*—The existing project, adopted in 1878, contemplated the protection of the Memphis Harbor front from further bank loss by the installation of spur dikes and woven willow revetment.

The formation of a sand bar which threatened to close the harbor to water-borne traffic led to the adoption of a project in 1917 which had for its object dredging and maintaining a navigable channel at the Memphis Wharf, keeping open the mouth of Hatchie River, and dredging Wolf River, and such other work as may be necessary in order to afford ample facilities for handling water-borne traffic.

*Operations and results during the fiscal year.*—Operations consisted in repairs to a small pocket cave just below the River and Rail incline, the maintenance of a channel along the paved wharf, dredging a channel through a sand bar in the Mississippi River near the entrance of the Loosa Hatchie River, dredg-

ing in Wolf River from the junction of that stream with the Loosa Hatchie River, and dredging in Loosa Hatchie River.

The repair work referred to above was accomplished by hired labor with Government plant from November 17, 1917 to December 6, 1917, at a cost of \$7,600.71.

The following table gives detailed costs:

MEMPHIS HARBOR, TENN. (232 L.), FIRST AND SECOND DISTRICTS.

*Mattresses, total area 257 squares (connecting mats, 100 per cent).*

BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square |        |
|--------------------------------------|-----------------|-------------|------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.  | Cost.  |
| Mobilization and demobilization..... |                 | \$128.07    |            | \$0.72 |
| 3/4-inch strand.....pounds.....      | 600             | 41.70       | 2.335      | 0.18   |
| 1/2-inch strand.....do.....          | 1,000           | 71.50       | 3.891      | 0.28   |
| 1/4-inch strand.....do.....          | 1,500           | 114.45      | 5.836      | 0.43   |
| Wire, No. 9.....do.....              | 1,150           | 43.36       | 4.475      | 0.33   |
| Staples.....do.....                  | 40              | 1.26        | .156       | 0.01   |
| Clips, 3/4-inch.....number.....      | 20              | 2.95        | .078       | 0.01   |
| Brush and poles.....cords.....       | 434.8           | 760.90      | 1.690      | 2.10   |
| Rope, manila.....pounds.....         | 678             | 210.18      | 2.634      | 0.19   |
| Miscellaneous expenses.....          |                 | 7.79        |            | 0.06   |
| Subsistence.....                     |                 | 264.16      |            | 1.86   |
| Labor.....                           |                 | 429.46      |            | 3.19   |
| Supervision.....                     |                 | 94.80       |            | 0.70   |
| Total.....                           |                 | 2,170.58    |            | 8.66   |
| Total field cost.....                |                 | 2,170.58    |            | 8.66   |

BALLASTING AND SINKING.

|                                      |     |          |       |        |
|--------------------------------------|-----|----------|-------|--------|
| Mobilization and demobilization..... |     | \$24.80  |       | \$0.66 |
| Stone.....tons.....                  | 370 | 843.60   | 1.051 | 3.22   |
| Rope, manila.....pounds.....         | 478 | 148.18   | 1.860 | 0.77   |
| Miscellaneous expenses.....          |     | 6.66     |       | 0.05   |
| Subsistence.....                     |     | 149.10   |       | 1.06   |
| Labor.....                           |     | 255.70   |       | 1.86   |
| Supervision.....                     |     | 43.60    |       | 0.32   |
| Total.....                           |     | 1,471.64 |       | 5.96   |
| Total field cost.....                |     | 1,471.64 |       | 5.96   |

*Grading (125 squares).*

| Items.                | Quantity used.  |             | Per square |        |
|-----------------------|-----------------|-------------|------------|--------|
|                       | Total quantity. | Total cost. | Quantity.  | Cost.  |
| Subsistence.....      |                 | \$91.60     |            | \$0.73 |
| Labor.....            |                 | 201.80      |            | 1.61   |
| Supervision.....      |                 | 26.40       |            | 0.21   |
| Total.....            |                 | 319.80      |            | 2.55   |
| Total field cost..... |                 | 319.80      |            | 2.55   |

*Paving (stone, 115 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$130.20    |             | \$1.132 |
| Stone.....tons.....                  | 555.1           | 1,265.63    | 4.828       | 11.005  |
| Rope, manila.....pounds.....         | 289             | 89.59       | 2.513       | .779    |
| Miscellaneous expenses.....          |                 | 11.05       |             | .096    |
| Subsistence.....                     |                 | 279.25      |             | 2.428   |
| Labor.....                           |                 | 448.14      |             | 3.897   |
| Supervision.....                     |                 | 97.60       |             | .849    |
| Total.....                           |                 | 2,321.46    |             | 20.186  |
| Total field cost.....                |                 | 2,321.46    |             | 20.186  |

*Summary of costs.*

| Items.                     | Subaqueous work. |            | Upper bank work. |            | Grand total. <sup>1</sup> |
|----------------------------|------------------|------------|------------------|------------|---------------------------|
|                            | Per square.      | Total.     | Per square.      | Total.     |                           |
| Total field cost.....      | \$14.172         | \$3,642.22 | \$22.744         | \$2,641.26 | \$6,283.48                |
| Repair of plant.....       | .588             | 151.22     | .950             | 109.50     | 260.72                    |
| Repair of plant.....       | .517             | 131.69     | .822             | 95.36      | 227.05                    |
| Depreciation of plant..... | 1.868            | 481.09     | 3.023            | 348.37     | 829.46                    |
| Total.....                 | 17.145           | 4,406.22   | 27.539           | 3,194.49   | 7,600.71                  |

<sup>1</sup> All repair work, hence the cost per linear foot of bank protected can not be given.

Dredging in Memphis Harbor was in operation at the time that the last annual report was submitted, but was suspended on June 15, 1917, on account of rapid rise in the river; dredging was resumed on July 1, 1917, and continued until October 22, 1917, when the dredges were laid up; dredging was again resumed on May 6, 1918, and is in progress at the time of writing this report. Dredging a channel through a sand bar in the Mississippi River near the entrance of the Loosa Hatchie River was commenced on July 16, 1917, but was suspended on July 31, 1917. Operations were again resumed at various intervals from March 8, 1918, to May 25, 1918. Dredging in Wolf River with dipper dredge Northern No. 2 was commenced on October 1, 1917, and completed on October 31, 1917. Dredging in Loosa Hatchie River with dipper dredge was commenced on September 13, 1917, and completed on September 30, 1917.

Of the foregoing dredging operations, 117,000 cubic yards were dredged by hired plant, at a cost of \$12,083.96, and 1,227,359 cubic yards were dredged by hired labor with Government plant, at a cost of \$107,978.33.

*Condition at the end of fiscal year.*—The condition of all bank-protection work in the Memphis Harbor is excellent. The depth and width of the channel along the paved wharf is ample to take care of all river-borne traffic, but dredges will have to be used to maintain it.

*Local cooperation.*—The town of Memphis contributed to the bank protection work above described, \$43,472.76.

*Terminal facilities.*—None.

*Effect of improvement.*—The town of Memphis has been relieved of the danger of property loss and its harbor maintained. The restrictions of the city's wharfage and river conveniences which existed at the end of the last fiscal year have been corrected by the Wolf River diversion canal and dredging along the paved wharf. In order to maintain the Memphis Harbor, dredging will probably have to be resorted to every low-water season.

*Proposed operations.*—It is proposed to continue dredging operations during the coming low-water season in the Memphis Harbor.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

## (1) Norfolk, Miss.

*Location and description.*—Two hundred and fifty-four miles below Cairo left bank.

*Original condition.*—Active caving began at this place in 1916, and, before steps could be taken to stop it, breached the levee, which necessitated the construction of a levee loop by the local levee board. Caving continued at an alarming rate again threatening the levee system. To prevent a recurrence of the breaching of the levee, revetment protection was authorized, the cost of same to be borne jointly by the Federal Government and the local levee district.

*Previous projects.*—None.

*Existing project.*—Adopted in 1917; contemplates the construction of about 3,000 linear feet of standard revetment located in a most advantageous relation to the levee system.

*Operations and results during the fiscal year.*—Operations consisted in the installation of 1,004 feet of standard fascine channel mattress. Grading and paving along this stretch, however, has not been done. The necessary plan and material for the prosecution of the work arrived at Norfolk, Miss., from Old Town, Ark., on October 22, 1917, and work was commenced on November 1, 1917. Work was suspended on December 12 on account of abnormal weather and river conditions. No further work was done, and the outfit was towed to Memphis on February 20, 1918.

The foregoing operations were accomplished by hired labor with Government plant, at a total cost of \$52,438.99.

The following table gives detailed costs:

## NORFOLK, MISS. (254 L.) FIRST AND SECOND DISTRICTS.

*Mattresses, total area 2,585 squares (channel mats., 97 per cent; connecting mats., 3 per cent).*

## BUILDING MATS.

| Items.                                  | Quantity used.  |             | Per square. |        |
|-----------------------------------------|-----------------|-------------|-------------|--------|
|                                         | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization.....    |                 | \$570.49    |             | \$0.22 |
| $\frac{1}{2}$ -inch strand.....pounds.. | 15,677          | 1,089.56    | 6.061       | .42    |
| $\frac{3}{4}$ -inch strand.....do.....  | 4,893           | 340.07      | 1.893       | .13    |
| $\frac{1}{2}$ -inch strand.....do.....  | 16,038          | 1,223.70    | 6.024       | .47    |
| Wire, No. 9.....do.....                 | 6,600           | 248.82      | 2.553       | .09    |
| Wire, silicon br.....do.....            | 243             | 7.65        | .094        | .00    |
| Staples.....do.....                     | 370             | 13.53       | .143        | .00    |
| Clips, $\frac{1}{2}$ -inch.....number.. | 1,203           | 134.73      | .465        | .05    |
| Clips, $\frac{3}{4}$ -inch.....do.....  | 1,141           | 72.69       | .441        | .02    |
| Brush and poles.....cords..             | 2,434.4         | 4,260.20    | .942        | 1.64   |
| Rope, manila.....pounds..               | 7,500           | 2,197.50    | 2.901       | .83    |
| Miscellaneous expenses.....             |                 | 457.60      |             | .17    |
| Subsistence.....                        |                 | 7,067.90    |             | 2.73   |
| Steamboat expense.....                  |                 | 5,289.94    |             | 2.04   |
| Labor.....                              |                 | 8,072.23    |             | 3.12   |
| Supervision.....                        |                 | 3,230.80    |             | 1.25   |
| Total.....                              |                 | 34,277.41   |             | 13.26  |
| Total field cost.....                   |                 | 34,277.41   |             | 13.26  |

## BALLASTING AND SINKING.

|                             |         |            |       |        |
|-----------------------------|---------|------------|-------|--------|
| Stone.....tons..            | 1,168.9 | \$2,665.09 | 0.452 | \$1.03 |
| Rope, manila.....pounds..   | 5,000   | 1,465.00   | 1.934 | .56    |
| Miscellaneous expenses..... |         | 271.02     |       | .10    |
| Subsistence.....            |         | 738.01     |       | .28    |
| Steamboat expense.....      |         | 661.34     |       | .25    |
| Labor.....                  |         | 1,801.67   |       | .69    |
| Supervision.....            |         | 491.80     |       | .19    |
| Total.....                  |         | 8,093.93   |       | 3.13   |
| Total field cost.....       |         | 8,093.93   |       | 3.13   |

*Summary of costs (1,004 linear feet revetted).*

|                            | Subaqueous work. |             | Grand total. <sup>1</sup> |
|----------------------------|------------------|-------------|---------------------------|
|                            | Per square.      | Total.      |                           |
| Total field cost.....      | \$16.391         | \$42,371.34 | \$42,371.34               |
| Office expenses.....       | .030             | 77.60       | 77.60                     |
| Surveys.....               | .298             | 769.48      | 769.48                    |
| Care of plant.....         | .706             | 1,825.06    | 1,825.06                  |
| Repair of plant.....       | .615             | 1,589.32    | 1,589.32                  |
| Depreciation of plant..... | 2.246            | 5,806.19    | 5,806.19                  |
| Total.....                 | 20.286           | 52,438.99   | 52,438.99                 |

<sup>1</sup> Total cost per linear foot can not be given on account of no upper bank work being done.

*Conditions at the end of fiscal year.*—Caving continues upstream from the upper end of the revetment. The work should be extended upstream for a distance of about 4,000 feet in order to fully protect the levee in this bend.

*Local cooperation.*—The Yazoo-Mississippi Delta Levee Board contributed \$100,000 toward the cost of revetment work at this place.

*Terminal facilities.*—None.

*Effect of improvement.*—This work is only partially completed; when completed it will insure the integrity of the levee which is being threatened by the caving bank.

*Proposed operations.*—Grading and paving along the stretch of channel mattress referred to above and extension upstream for about 2,000 feet, with the available balance. A further upstream extension of about 2,000 feet will be required when the necessary funds become available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*(m) Star Landing, Miss.*

*Location and description.*—Two hundred and fifty-seven miles below Cairo, left bank.

*Original condition.*—Caving in Star Landing Bend had been persistently active for a number of years, to the extent that the adjacent levees were several times breached, necessitating the construction of some four levee loops. In 1912 and 1913 the rate of caving was such as to again seriously threaten the levee system, to guard against which revetment protection was authorized at the combined cost of the Federal Government and the local levee district.

*Previous projects.*—None.

*Existing project.*—Adopted in 1914; contemplates the construction of about 10,000 linear feet of standard fascine revetment, located in the most advantageous relation to the levee system.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—All revetment except about 3,000 feet destroyed is in excellent condition.

*Local cooperation.*—The Yazoo-Mississippi Delta Levee Board contributed to the cost of the work in place the sum of \$210,000.

*Terminal facilities.*—None.

*Effect of improvement.*—Notwithstanding the destruction of about 3,000 feet of revetment, the integrity of the levees has been maintained. Abnormal currents developed in the river during the high water of 1917 which attacked and destroyed the work referred to above. The channel appears to be in a state of transition, due no doubt to changes in the bend above.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

## (n) Porter Lake, Ark.

*Location and description.*—Two hundred and sixty-one miles below Cairo, right bank.

*Original condition.*—Prior to 1910 more or less intermittent caving had taken place in the vicinity of Porter Lake, though dangerous proximity to the Arkansas levee had not developed until about the year named. The importance of maintaining the existing levee line centers in the fact that a number of lakes are found in such relation thereto that a levee loop, which of necessity would have to be located behind the said lakes, would in consequence have been very extensive and costly. The alternative was, therefore, the construction of revetment to the end of holding the channel to position and of maintaining the existing levee line.

*Previous projects.*—None.

*Existing project.*—Authorized in 1911; contemplated the construction of standard fascine revetment to prevent further bank caving.

*Operations and results during the fiscal year.*—Operations consisted in the installation of 2,790 feet of standard fascine channel mattress with the necessary connecting mattresses. Paving along this stretch, however, has not been fully completed. The work was in progress at the time that the last annual report was submitted, but was suspended on June 9, 1917, on account of high water; operations were resumed on July 3, 1917, but were again suspended on January 10, 1918, on account of enormous ice flows and no work was done until March 16, 1918, when operations were resumed again and are still in progress.

The foregoing operations were accomplished by hired labor with Government plant, at a total cost of \$196,406.94.

The following table gives detailed costs:

## PORTER LAKE, ARK. (261 R.), FIRST AND SECOND DISTRICTS.

*Mattresses, total area, 10,658 squares (channel mats, 64 per cent; connecting mats, 36 per cent).*

## BUILDING MATS.

| Items.                                  | Quantity used.  |             | Per square. |         |
|-----------------------------------------|-----------------|-------------|-------------|---------|
|                                         | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization.....    |                 | \$100.19    |             | \$0.010 |
| $\frac{1}{2}$ -inch strand.....pounds.. | 41,160          | 2,781.62    | 3.682       | .261    |
| $\frac{3}{8}$ -inch strand.....do.....  | 17,125          | 954.08      | 1.607       | .090    |
| $\frac{1}{4}$ -inch strand.....do.....  | 58,300          | 4,168.45    | 5.470       | .391    |
| Wire, No. 9.....do.....                 | 27,392          | 1,183.92    | 2.570       | .111    |
| Wire, silicon bronze.....do.....        | 1,172           | 240.26      | .110        | .023    |
| Staples.....do.....                     | 1,580           | 52.27       | .148        | .005    |
| Clips, $\frac{1}{2}$ -inch.....number.. | 2,940           | 391.26      | .276        | .037    |
| Clips, $\frac{3}{8}$ -inch.....do.....  | 2,767           | 223.30      | .259        | .021    |
| Brush and poles.....cords..             | 13,941          | 25,099.04   | 1.308       | 2.355   |
| Rope, manila.....pounds..               | 10,000          | 2,930.00    | .938        | .275    |
| Miscellaneous expenses.....             |                 | 2,382.67    |             | .223    |
| Subsistence.....                        |                 | 16,206.17   |             | 1.520   |
| Steamboat expenses.....                 |                 | 16,707.06   |             | 1.567   |
| Labor.....                              |                 | 20,390.38   |             | 1.913   |
| Supervision.....                        |                 | 6,576.03    |             | .617    |
| Total.....                              |                 | 100,386.70  |             | 9.419   |
| Total field cost.....                   |                 | 100,386.70  |             | 9.419   |

## BALLASTING AND SINKING.

|                                      |         |           |       |         |
|--------------------------------------|---------|-----------|-------|---------|
| Mobilization and demobilization..... |         | \$34.07   |       | \$0.003 |
| Stone.....tons..                     | 7,462.3 | 17,014.04 | 0.700 | 1.596   |
| Rope, manila.....pounds..            | 250.0   | 732.50    | .234  | .069    |
| Miscellaneous expenses.....          |         | 434.21    |       | .040    |
| Subsistence.....                     |         | 4,042.07  |       | .380    |
| Steamboat expenses.....              |         | 3,726.92  |       | .350    |
| Labor.....                           |         | 5,160.05  |       | .484    |
| Supervision.....                     |         | 1,372.80  |       | .129    |
| Total.....                           |         | 32,516.66 |       | 3.051   |
| Total field cost.....                |         | 32,516.66 |       | 3.051   |

*Grading (3,564 squares).*

| Items.                              | Quantity used.  |             | Per square. |          |
|-------------------------------------|-----------------|-------------|-------------|----------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.    |
| obilization and demobilization..... |                 | \$55. 89    |             | \$0. 017 |
| ope, manila.....pounds..            | 250. 0          | 732. 50     | 0. 701      | .205     |
| cal.....tens..                      | 276. 6          | 979. 10     | .077        | .276     |
| il.....                             |                 | 9. 45       |             | .002     |
| iscellaneous expenses.....          |                 | 238. 28     |             | .065     |
| bsistence.....                      |                 | 2, 289. 03  |             | .642     |
| eamboat expenses.....               |                 | 1, 299. 60  |             | .366     |
| abor.....                           |                 | 4, 912. 18  |             | 1. 378   |
| ipervision.....                     |                 | 721. 29     |             | .202     |
| Total.....                          |                 | 11, 237. 32 |             | 3. 153   |
| Total field cost.....               |                 | 11, 237. 32 |             | 3. 153   |

*Paving stone (643 squares).*

| Items.                              | Quantity used.  |             | Per square. |          |
|-------------------------------------|-----------------|-------------|-------------|----------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.    |
| obilization and demobilization..... |                 | \$102. 07   |             | \$0. 159 |
| one.....tons..                      | 2, 120. 4       | 4, 831. 51  | 3. 300      | 7. 519   |
| ope, manila.....pounds..            | 250. 0          | 732. 50     | 3. 888      | 1. 139   |
| iscellaneous expenses.....          |                 | 265. 36     |             | .413     |
| bsistence.....                      |                 | 2, 859. 69  |             | 4. 447   |
| eamboat expenses.....               |                 | 2, 023. 63  |             | 3. 147   |
| abor.....                           |                 | 2, 266. 82  |             | 3. 525   |
| ipervision.....                     |                 | 1, 027. 72  |             | 1. 598   |
| Total.....                          |                 | 14, 112. 30 |             | 21. 947  |
| Total field cost.....               |                 | 14, 112. 30 |             | 21. 947  |

*Summary of costs.*

|                          | Subaqueous work. |                | Upper bank work. |               | Grand total. <sup>1</sup> |
|--------------------------|------------------|----------------|------------------|---------------|---------------------------|
|                          | Per square.      | Total.         | Per square.      | Total.        |                           |
| Total field cost.....    | \$12. 470        | \$132, 903. 36 | \$25. 100        | \$25, 319. 62 | \$158, 252. 98            |
| ice expenses.....        | .141             | 1, 505. 94     | .284             | 286. 85       | 1, 792. 79                |
| rveys.....               | .063             | 668. 72        | .126             | 127. 38       | 796. 10                   |
| re of plant.....         | .555             | 5, 913. 20     | 1. 114           | 1, 126. 32    | 7, 039. 52                |
| pair of plant.....       | .483             | 5, 149. 40     | .970             | 980. 81       | 6, 130. 24                |
| preciation of plant..... | 1. 765           | 18, 812. 96    | 3. 546           | 3, 582. 35    | 22, 395. 31               |
| Total.....               | 15. 477          | 164, 953. 58   | 31. 340          | 31, 453. 36   | 196, 406. 94              |

<sup>1</sup> Total cost per linear foot can not be given on account of bank work not being completed.

*Condition at the end of fiscal year.*—Caving continues downstream from the lower end of the revetment. The work should be extended downstream for a distance of about 5,000 feet, and repairs should be made to some breaks in the revetment which extend along the old revetment for a distance of about 2,000 feet beginning about 2,500 feet below the upstream end of the revetment, in order to fully protect the levee in this bend.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The revetment described has fixed the channel and is maintained a stable bank throughout the upper part of the Porter Lake

Bend. The adjacent levee has been protected. For continued similar result the portion of the lower work destroyed must be replaced and work extended downstream to cover the recent actively caving bank.

*Proposed operations.*—It is proposed to complete the paving along the stretch of work installed during this fiscal year with the available balance. A further extension downstream of 4,000 feet of revetment and repairs to the break in bank paving referred to above should be done as soon as necessary funds become available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

#### (c) Walnut Bend, Ark.

*Location and description.*—Two hundred and eighty-one miles below Cairo right bank.

*Original condition.*—Bank caving throughout Walnut Bend finally brought the Mississippi River into such relation to the St. Francis River as to suggest the danger of cutoff between the two. Moreover, the river bank had approached the Arkansas levee to the point that the latter was in imminent hazard of being breached, a condition that would have required the construction of an expensive levee loop. The combined situations, therefore, finally led, in 1907, to the necessity that Walnut Bend be protected by revetment.

*Previous projects.*—None.

*Existing project.*—The existing project, initiated in 1907, provided for the installation of about 7,000 feet of standard fascine revetment, placed with relation to the adjacent levee, and with due regard to the possibility of cutoff between the Mississippi and St. Francis Rivers.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—The entire length of revetment is in excellent condition. A resumption of active caving at the lower end of the bend is observed, though the existing revetment is not affected thereby. For several years past a deepening is noted at the outer edge of the downstream end of the work, though its extent is not sufficient to suggest any serious instability of the construction.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—Walnut Bend has been made stable throughout the length of its revetment; the adjacent levee has been safeguarded from destruction, and whatever danger of cutoff between the Mississippi and St. Francis Rivers may have existed has been eliminated.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

#### (p) Trotters, Miss.

*Location and description.*—Three hundred and four miles below Cairo, left bank.

*Original condition.*—For many years bank caving throughout Trotters bend was persistent, with the result that the river, in 1912, had attained hazardous proximity to the Mississippi Levee near the lower end of the bend. The estimated cost of a levee loop was such that the alternative of bank revetment was concluded upon.

*Previous projects.*—None.

*Existing project.*—Adopted in 1912; provides for controlling this bend and protecting the adjacent levee by the installation of continuous bank revetment.

*Operations and results during the fiscal year.*—An outfit arrived at Trotters, Miss., for making some minor repairs to upper bank paving and to a small pocket cave on December 8, 1917, but on account of abnormal weather and river conditions, work did not commence until January 5, 1918. Operations were again suspended on January 11, 1918, for the same reason, and the outfit

oved to Memphis on February 8, 1918. Operations during the period from January 5 to 11, 1918, consisted in the building and sinking of a small connecting mattress, 48 squares in area, and grading 300 squares of bank.

The foregoing operations were accomplished by hired labor with Government plant, at a cost of \$9,035.03.

The following table gives detailed costs:

TROTTERS, MISS. (304 L.), FIRST AND SECOND DISTRICTS.

*Mattresses, total area, 48 squares. Connecting mats, 100 per cent.*

BUILDING MATS.

| Items.                              | Quantity used.  |             | Per square. |         |
|-------------------------------------|-----------------|-------------|-------------|---------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization..... |                 | \$125.00    |             | \$2.504 |
| inch strand.....pounds.....         | 400             | 27.24       | 8.333       | .567    |
| inch strand.....do.....             | 600             | 42.90       | 12.500      | .894    |
| inch strand.....do.....             | 450             | 38.33       | 9.375       | .799    |
| ire, No. 9.....pounds.....          | 260             | 9.83        | 5.417       | .205    |
| ples.....do.....                    | 15              | .46         | .313        | .009    |
| ps, 1-inch.....number.....          | 10              | 1.48        | .222        | .031    |
| ush and poles.....cords.....        | 65              | 123.50      | 1.354       | 2.573   |
| scellaneous expenses.....           |                 | 21.00       |             | .438    |
| ssistance.....                      |                 | 701.50      |             | 14.624  |
| amboat expenses.....                |                 | 1,350.00    |             | 28.125  |
| bor.....                            |                 | 926.40      |             | 19.300  |
| ervision.....                       |                 | 241.80      |             | 5.038   |
| Total.....                          |                 | 3,609.44    |             | 75.197  |
| Total field cost.....               |                 | 3,609.44    |             | 75.197  |

BALLASTING AND SINKING.

|                                     |    |         |       |         |
|-------------------------------------|----|---------|-------|---------|
| obilization and demobilization..... |    | \$60.00 |       | \$1.250 |
| me.....tons.....                    | 10 | 22.80   | 0.222 | .475    |
| scellaneous expenses.....           |    | 5.69    |       | .119    |
| ssistance.....                      |    | 213.03  |       | 4.438   |
| amboat expenses.....                |    | 243.35  |       | 5.170   |
| bor.....                            |    | 263.46  |       | 4.489   |
| ervision.....                       |    | 98.70   |       | 2.057   |
| Total.....                          |    | 907.03  |       | 18.897  |
| Total field cost.....               |    | 907.03  |       | 18.897  |

*Grading (300 squares).*

| Items.                              | Quantity used.  |             | Per square. |         |
|-------------------------------------|-----------------|-------------|-------------|---------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization..... |                 | \$140.00    |             | \$0.467 |
| scellaneous expenses.....           |                 | 33.91       |             | .113    |
| ssistance.....                      |                 | 1,000.58    |             | 3.333   |
| amboat expenses.....                |                 | 260.10      |             | .867    |
| bor.....                            |                 | 1,347.45    |             | 4.492   |
| ervision.....                       |                 | 419.30      |             | 1.399   |
| Total.....                          |                 | 3,201.34    |             | 10.671  |
| Total field cost.....               |                 | 3,201.34    |             | 10.671  |

*Summary of costs.*

|                            | Subaqueous work. |            | Upper bank work. |            | Grand total. <sup>1</sup> |
|----------------------------|------------------|------------|------------------|------------|---------------------------|
|                            | Per square.      | Total.     | Per square.      | Total.     |                           |
| Total field cost.....      | 94.034           | \$4,516.47 | 10.671           | \$3,201.34 | \$7,717.                  |
| Care of plant.....         | 2.977            | 142.81     | .393             | 117.90     | 260.                      |
| Repair of plant.....       | 2.740            | 131.69     | .318             | 95.36      | 227.                      |
| Depreciation of plant..... | 10.023           | 481.09     | 1.161            | 348.37     | 829.                      |
| Total.....                 | 109.834          | 5,272.06   | 12.543           | 3,762.97   | 9,035.                    |

<sup>1</sup> All repair work, hence the cost per linear foot of bank protection can not be given.

*Condition at the end of fiscal year.*—The revetment, with the exception of the upper 1,500 feet, is in effective condition. Repairs should be made to the upper 1,500 feet during the coming season.

Caving continues throughout the upper part of the bend, and will probably require during the next few years an upstream extension of the work in place.

*Local cooperation.*—The Yazoo-Mississippi Delta Levee Board contribute \$100,000 to the cost of the Trotters revetment.

*Terminal facilities.*—None.

*Effect of improvement.*—The lower end of the bend has been made stable the confronting channel fixed, and the adjacent Mississippi River Levee maintained, thus eliminating the alternative necessity for the construction of a costly levee loop.

*Proposed operations.*—It is proposed to make repairs to the upper 1,500 feet of bank revetment referred to above during the coming low-water season. It is probable that an upstream extension of the existing work may be required within the next few years.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(q) *Helena, Ark.*

*Location and description.*—Three hundred and six miles below Cairo, right bank.

*Original condition.*—The river bank in the vicinity of Helena during the eighties showed intermittent sloughs or settlements in the nature rather of vertical sinks than of the ordinary bank caving. The difference was recognized as is evident from the statement regarding the low ground immediately behind the Helena levee which in 1888 was referred to as "a swamp \* \* \* which seems to have been the most prolific cause of caving for some years past." To minimize the supposed effects of this swamp, it was proposed that this low ground should be drained by way of a canal to the south. By 1888 the settlements or sinks referred to had caused bank recession to the point of jeopardizing the property and industries of the town. These sinks or subsidences of greater or less extent continued to occur at irregular intervals till in 1913 the most extensive of all appeared.

*Previous projects.*—None.

*Existing project.*—The existing project was adopted in 1888 and contemplated the construction of fascine revetment and spur dikes along the Helena front to the extent necessary to make stable bank conditions in that locality.

In addition, by a special item in the river and harbor act of March 4, 1911 \$100,000 was provided "to prevent a breach in the Helena front levee by revetment or otherwise."

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—During the past low-water season the foreshore has shown no evidence of instability.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*Effect of improvement.*—The revetment work along the Helena front has protected the town and its industries to the south from encroachment by the river. It has not, however, provided against subsidence of the foreshore, the stability of which has reappeared at irregular intervals.

*Local cooperation.*—None.

*Terminal facilities.*—None.

The deposit of stable hill earth over the disturbed area is shown by borings to have forced out practically all underlying unstable material for a short distance, which suggests that continued, though indefinite fill, following further evidence of instability, may be expected to restore conditions of essential equilibrium.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

(r) *Delta, Miss.*

*Location and description.*—Three hundred and fifteen miles below Cairo, left bank.

*Original condition.*—Caving at this point, which had been active for a number of years, developed, in 1914, a condition of such menace to the controlling levee, located between the river bank and the foot of Moon Lake, as to require the revetment of the Delta Bend. The destruction of the levee would have necessitated the construction of a long and expensive loop around the said lake. To guard against such a contingency revetment protection was authorized at the combined cost of the Federal Government and local levee district.

*Previous projects.*—None.

*Existing project.*—The existing project adopted in 1915, contemplated the installation of about 9,000 feet of standard fascine revetment located in required relation to the levee system.

*Operations and results during the fiscal year.*—Operations consisted in making some minor repairs to a small break in the upper bank paving. The concrete bank paving outfit arrived at Delta on December 5, and work was commenced at once and finished on the 8th, when the outfit was towed to a safe harbor at Helena, Ark.

The foregoing operations were accomplished by hired labor with Government grant at a total cost of \$1,312.95.

The following table gives detailed costs:

DELTA, MISS. (315 L.), FIRST AND SECOND DISTRICTS.

*Paving (concrete, 60 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$111.75    |             | \$1.863 |
| Cement.....sacks..                   | 500             | 230.00      | 8.333       | 3.833   |
| Sand and gravel.....cubic yards..    | 120             | 51.60       | 2.000       | .860    |
| Oil.....tons..                       | 9               | 40.50       | .150        | .675    |
| Minor miscellaneous expenses.....    |                 | 7.28        |             | .121    |
| Assistance.....                      |                 | 156.92      |             | 2.615   |
| Harbor boat expenses.....            |                 | 272.72      |             | 4.545   |
| Harbor.....                          |                 | 67.00       |             | 1.117   |
| Supervision.....                     |                 | 111.75      |             | 1.863   |
| Total.....                           |                 | 1,049.52    |             | 17.492  |
| Total field cost.....                |                 | 1,049.52    |             | 17.492  |

*Summary of costs.*

|                            | Upper bank work. |                     |
|----------------------------|------------------|---------------------|
|                            | Per square.      | Total. <sup>1</sup> |
| Total field cost.....      | \$17.492         | \$1,049.8           |
| Care of plant.....         | .869             | 52.1                |
| Repair of plant.....       | .756             | 45.4                |
| Depreciation of plant..... | 2.765            | 165.8               |
| Total.....                 | 21.882           | 1,312.9             |

<sup>1</sup> All repair work, hence the cost per linear foot of bank protected can not be given.

*Condition at the end of fiscal year.*—The entire revetment is in excellent condition. The extension of the work downstream may be required at some future date.

*Local cooperation.*—The Yazoo-Mississippi Levee Board contributed \$160,000 to the cost of the work.

*Terminal facilities.*—None.

*Effect of improvement.*—The channel in Delta Bend has been fixed throughout the stretch revetted, further bank caving prevented, and the necessity for the construction of a costly levee loop around Moon Lake obviated.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River

(s) *Oldtown, Ark.*

*Location and description.*—Three hundred and twenty-four miles below Cairo right bank.

*Original condition.*—Continued caving over a number of years prior to 1907 finally required, in that year, revetment of Oldtown Bend or the construction of a levee loop, the river bank having receded almost to the toe of the existing levee.

*Previous projects.*—None.

*Existing project.*—The existing project was adopted in 1907 and contemplated the installation of sufficient revetment to fix the channel and bank line throughout the bend and thus to protect the adjacent Arkansas levee.

*Operations and results during the fiscal year.*—Operations consisted in the installation of 2,484 feet of revetment and grading and paving the bank along this stretch. The work was in progress at the time that the last annual report was submitted, but was suspended on June 9, 1917, on account of high water operations were resumed on July 5, 1917, and continued until the completion of the work on December 4, 1917. On October 21, 1917, the mattress plant and grading outfit was moved to Norfolk, Miss., leaving a bank paving plant to complete the upper bank work.

The foregoing operations were accomplished by hired labor with Government plant at a total cost of \$141,446.21.

The following table gives detailed costs:

OLD TOWN BEND (324 R.) FIRST AND SECOND DISTRICTS.

tires, total area, 8,579 squares (channel mats, 63 per cent; connecting mats, 37 per cent).

BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization..... |                 | \$373.13    |             | \$0.043 |
| ch strands..... pounds.....          | 29,033          | 2,017.80    | 3.384       | .235    |
| ch strand..... do.....               | 15,951          | 873.03      | 1.859       | .102    |
| ch strand..... do.....               | 4,118           | 3,137.30    | 4.792       | .366    |
| le No. 9..... do.....                | 21,448          | 980.58      | 2.500       | .113    |
| le, silicon brand..... do.....       | 785             | 160.93      | .091        | .019    |
| les..... do.....                     | 1,420           | 47.52       | .166        | .006    |
| s, 1-inch..... number.....           | 1,946           | 217.95      | .227        | .025    |
| s, 1/2-inch..... do.....             | 2,289           | 145.81      | .266        | .017    |
| sh and poles..... cord.....          | 9,695.2         | 16,966.61   | 1.130       | 1.978   |
| le, manila..... pounds.....          | 2,140           | 627.02      | .249        | .077    |
| ellaneous expenses.....              |                 | 910.48      |             | .105    |
| sistence.....                        |                 | 6,175.13    |             | .710    |
| mboat expenses.....                  |                 | 8,194.14    |             | .954    |
| or.....                              |                 | 11,716.14   |             | 1.364   |
| ervision.....                        |                 | 2,674.84    |             | .312    |
| Total.....                           |                 | 55,218.41   |             | 6.436   |
| Total field cost.....                |                 | 55,218.41   |             | 6.436   |

BALLASTING AND SINKING.

|                                     |         |           |       |         |
|-------------------------------------|---------|-----------|-------|---------|
| obilization and demobilization..... |         | \$68.72   |       | \$0.008 |
| o..... tons.....                    | 7,730.8 | 17,626.22 | 0.901 | 2.055   |
| o, manila..... pounds.....          | 1,120   | 328.16    | .131  | .038    |
| ellaneous expenses.....             |         | 84.49     |       | .010    |
| sistence.....                       |         | 921.63    |       | .108    |
| mboat expenses.....                 |         | 1,976.93  |       | .230    |
| or.....                             |         | 3,752.72  |       | .438    |
| ervision.....                       |         | 757.22    |       | .088    |
| Total.....                          |         | 25,516.09 |       | 2.975   |
| Total field cost.....               |         | 25,516.09 |       | 2.975   |

Grading (3,470 squares).

| Items.                              | Quantity used.  |             | Per square. |         |
|-------------------------------------|-----------------|-------------|-------------|---------|
|                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization..... |                 | \$28.15     |             | \$0.007 |
| o, manila..... pounds.....          | 960             | 281.28      | 0.277       | .081    |
| o..... tons.....                    | 292             | 1,250.00    | .082        | .361    |
| ellaneous expenses.....             |                 | 25.69       |             | .007    |
| sistence.....                       |                 | 237.46      |             | .069    |
| mboat expenses.....                 |                 | 1,087.42    |             | .312    |
| or.....                             |                 | 334.77      |             | .097    |
| ervision.....                       |                 | 2,852.85    |             | .822    |
| .....                               |                 | 555.84      |             | .161    |
| Total.....                          |                 | 6,653.46    |             | 1.917   |
| Total field cost.....               |                 | 6,653.46    |             | 1.917   |

*Paving.*

| Items.                                | Stone (245 squares). |             |             |         | Concrete (4,583 squares). |             |             |       |
|---------------------------------------|----------------------|-------------|-------------|---------|---------------------------|-------------|-------------|-------|
|                                       | Quantity used.       |             | Per square. |         | Quantity used.            |             | Per square. |       |
|                                       | Total quantity.      | Total cost. | Quantity.   | Cost.   | Total quantity.           | Total cost. | Quantity.   | Cost. |
| Mobilization and demobilization.....  |                      |             |             |         |                           | \$361.64    |             | \$0.  |
| Stone..... tons.....                  | 741.4                | \$1,690.39  | 3.026       | \$3.899 |                           |             |             |       |
| Rope, manila..... pounds.....         | 170                  | 49.81       | .694        | .203    | 600                       | 175.80      | 0.131       |       |
| Cement..... sacks.....                |                      |             |             |         | 18,489                    | 8,504.94    | 4.034       | 1.    |
| Sand and gravel..... cubic yards..... |                      |             |             |         | 5,735.8                   | 2,478.68    | 1.252       |       |
| Coal..... tons.....                   |                      |             |             |         | 131                       | 559.50      | .029        |       |
| Oil.....                              |                      |             |             |         |                           | 10.50       |             |       |
| Miscellaneous expenses.....           |                      | 13.33       |             | .054    |                           | 82.77       |             |       |
| Subsistence.....                      |                      | 587.50      |             | 2.398   |                           | 3,028.41    |             |       |
| Steamboat expenses.....               |                      | 104.22      |             | .671    |                           | 2,952.48    |             |       |
| Labor.....                            |                      | 1,146.66    |             | 4.680   |                           | 3,320.14    |             |       |
| Supervision.....                      |                      | 124.20      |             | .508    |                           | 1,710.24    |             |       |
| Total.....                            |                      | 3,776.11    |             | 15.413  |                           | 23,195.05   |             | 5.    |
| Total field cost.....                 |                      | 3,776.11    |             | 15.413  |                           | 23,195.05   |             | 5.    |

*Summary of costs (2,484 linear feet revetted).*

|                            | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|----------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                            | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....      | \$9.411          | \$80,734.50 | \$12.154         | \$33,624.62 | \$114,359.12 | \$46                        |
| Office expenses.....       | .058             | 502.28      | .077             | 215.26      | 717.54       |                             |
| Surveys.....               | .024             | 201.95      | .032             | 86.55       | 288.50       |                             |
| Care of plant.....         | .421             | 3,613.62    | .559             | 1,548.70    | 5,162.32     | 2                           |
| Repair of plant.....       | .367             | 3,146.86    | .484             | 1,348.65    | 4,495.51     | 1                           |
| Depreciation of plant..... | 1.340            | 11,496.25   | 1.784            | 4,926.97    | 16,423.22    | 6                           |
| Total.....                 | 11.621           | 99,695.46   | 15.090           | 41,750.75   | 144,446.21   | 56                          |

*Condition at the end of fiscal year.*—The revetment is in excellent condition. A small break in the concrete bank pavement occurred in March, 1918, near the lower end of the work, which should be repaired during the coming low water season.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The Arkansas Levee, adjacent to the upper end of Oldtown Bend, has been protected and the necessity for a costly substitute has been avoided.

*Proposed operations.*—Repairs to break in bank paving referred to above.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*(t) Sunflower, Miss.*

*Location and description.*—Three hundred and fifty-five miles below Cairo, left bank.

*Original condition.*—Caving in Sunflower Bend, active for a number of years, finally brought the bank of the river practically to the toe of the Mississippi Levee, thus requiring that the latter be reconstructed, or that revetment be placed for its protection.

*Previous projects.*—None.

*Existing project.*—Initiated in 1911; provided for sufficient revetment to fix channel and bank conditions throughout the bend, thus making possible the retention of the adjacent levee.

*Operations and results during the fiscal year.*—None.

*Condition at the end of fiscal year.*—Sloughs have occurred in the bank in this bend to such an extent that to restore this work will require about 3,000 feet of revetment with the necessary grading and bank paving.

*Local cooperation.*—The Yazoo-Mississippi Delta Levee Board contributed to the cost of the work the sum of \$92,500.

*Terminal facilities.*—None.

*Effect of improvement.*—The river channel and bank throughout Sunflower bend has been made generally stable, the adjacent levee guarded against destruction, and the construction of an extensive and costly levee loop has been avoided.

*Proposed operations.*—Repairs to the sloughs mentioned above, consisting of 3,000 feet of revetment, during the coming season as soon as the necessary funds become available, and the possible extension of the work downstream in the near future.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

First and second Mississippi River Commission districts—Data of cost of reversion June 1, 1917, to May 31, 1918.

| Location.                 | Expended as per financial statement. | Credit by material on hand. | Total field cost. | Field unit cost. |                  | Overhead unit cost. |                  | Work accomplished.   |              | Total cost of work. | Gross unit cost. <sup>1</sup> |                  | Remarks.                                                     |
|---------------------------|--------------------------------------|-----------------------------|-------------------|------------------|------------------|---------------------|------------------|----------------------|--------------|---------------------|-------------------------------|------------------|--------------------------------------------------------------|
|                           |                                      |                             |                   | Per square.      | Per linear foot. | Per square.         | Per linear foot. | Square. <sup>2</sup> | Linear feet. |                     | Per square.                   | Per linear foot. |                                                              |
| Gayoso Bend, Mo.....      | \$135,631.84                         | \$16,015.49                 | \$116,634.16      | \$13.63          | .....            | \$3.69              | .....            | 7,847                | 2,200        | \$145,875.16        | \$18.59                       | .....            | Bank paying not completed. Grading and paving not completed. |
| Barfield, Ark.....        | 146,558.50                           | 13,601.00                   | 131,234.61        | 12.42            | .....            | 2.91                | .....            | 10,563               | 2,822        | 161,936.35          | 15.33                         | .....            |                                                              |
| Hopefield Bend, Ark.....  | 9,747.72                             | 1,091.71                    | 8,656.01          | 13.46            | .....            | 4.25                | .....            | 643                  | .....        | 11,390.46           | 17.71                         | .....            | Repairs to existing works. Do.                               |
| Memphis Harbor, Tenn..... | 6,611.47                             | 327.99                      | 6,283.48          | 16.89            | .....            | 3.54                | .....            | 372                  | .....        | 7,600.71            | 20.45                         | .....            |                                                              |
| Norfolk, Miss.....        | 350,000.00                           | 22,444.92                   | 42,371.34         | 16.39            | .....            | 3.89                | .....            | 2,585                | 1,004        | 52,438.99           | 20.29                         | .....            | No upper bank work done.                                     |
| Porter Lake, Ark.....     | 13,818.29                            | 17,315.82                   | 158,252.98        | 14.00            | .....            | 3.38                | .....            | 11,301               | 2,790        | 196,406.94          | 17.38                         | .....            | Bank paying not completed. Repairs to existing works. Do.    |
| Trotters, Miss.....       | 164,515.98                           | 3,176.11                    | 7,718.71          | 22.18            | .....            | 3.79                | .....            | 348                  | .....        | 9,035.03            | 25.97                         | .....            |                                                              |
| Delta, Miss.....          | 4,821.17                             | 1,973.90                    | 1,049.52          | 17.48            | .....            | 4.39                | .....            | 60                   | .....        | 1,312.95            | 21.88                         | .....            | Do.                                                          |
| Old Town Bend, Ark.....   | 2,202.25                             | 2,041.71                    | 114,359.12        | 8.53             | \$46.04          | 2.02                | \$10.91          | 13,407               | 2,484        | 141,446.21          | 10.55                         | \$56.95          |                                                              |
|                           | 86,296.45                            |                             |                   |                  |                  |                     |                  |                      |              |                     |                               |                  |                                                              |

<sup>1</sup> Includes every item of field and overhead charges.<sup>2</sup> Squares include both subaqueous and upper bank work.<sup>3</sup> Amount expended from contributed funds from Upper Yazoo levee district of Mississippi.<sup>4</sup> Amount expended for account of this work from allotment for "General repairs and stone."

## II. EXPERIMENTAL REVETMENT.

From funds made available by the river and harbor bill approved July 27, 1916, the Mississippi River Commission allotted the sum of \$150,000 for the construction of one complete unit with which to place subaqueous concrete revetment with a view of substituting this type of shore protection for the standard willow fascine type.

Work of procuring the necessary plant is in progress. Contract for the construction of a steel machinery barge has been let. Bids for a concrete mixing plant were invited but no satisfactory bids were received; bids will be again invited in the near future. The machinery, trusses, etc., for the operation of the plant have been completed by the Bucyrus Co., of South Milwaukee, Wis., and one slab barge at the Government fleet, Memphis, Tenn. It is hoped to have the unit completed in time to place some concrete revetment work before the end of the coming working season.

## III. WOLF RIVER.

*Location and description.*—Two hundred and thirty miles below Cairo, left bank.

The work of improving Wolf River has been merged in the work of maintaining a navigable channel along the paved wharf of Memphis Harbor.

For description and previous history, see Annual Report, Chief of Engineers, 1916, Part III, page 3408.

## IV. LEVEES.

*General.*—All levees are being constructed to the grade and section fixed by the Mississippi River Commission by resolution adopted April, 1914, which provides that the grade shall be 3 feet above the deduced confined flood of 1912, with section having a crown 8 feet wide, river slope 3 to 1, land slope 3 to 1 to from 5 to 8 below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee, with back slope of 4 to 1.

## (a) Upper St. Francis district.

*Location and description.*—On the right bank of the river from Cape Girardeau, Mo., 54 miles above Cairo, to New Madrid, Mo., 70 miles below. This district comprises an area of about 700 square miles.

*Original condition.*—The United States made its first levee expenditure in this district in 1899. At that time there existed fragments of levees constructed by local boards and individual land owners, but nothing to be dignified as a levee system. The most important of these several detached lengths of levee were found between Commerce and the Iron Mountain Railroad, and from Birds Point for about 3 miles south. They merely joined the relatively higher ridges found variously along the upper St. Francis front and were capable of restraining only the mildest overflows.

*Previous projects.*—None.

*Existing project.*—The present project is to complete the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1899. It has been modified from time to time, and at present contemplates the enlargement of the existing line, in cooperation with the State and local levee boards, to the grade and section adopted by the Mississippi River Commission April 19, 1914.

This levee line, when complete, will have a total length of about 87 miles.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, 877,755 cubic yards, at a total cost of \$157,637.24. Six and one-fifth miles of levee was enlarged and 1.1 miles of new levee extension completed, both to 1914 commission grade.

Contracts in force at the beginning of the year and those since executed are given in the following table, which includes a statement of the date, or percentage, of completion of each.

| Location.       | Class.        | Miles from Cairo. | Cubic yards. | Price.                 | Contractor.                           | Completed May 31, 1917. |
|-----------------|---------------|-------------------|--------------|------------------------|---------------------------------------|-------------------------|
| <i>Above.</i>   |               |                   |              |                        |                                       |                         |
| 20/16-22/0....  | Enlargement.. | 26 R.....         | 122,349      | <i>Cents.</i><br>21.00 | R. L. Leonard.....                    | 99 per cent.            |
| 22/0-24/0....   | .....do.....  | 24½ R.....        | 202,595      | 26.95                  | .....do.....                          | Com. Apr. 1918.         |
| 24/0-26/15....  | .....do.....  | 23 R.....         | 177,435      | 21.00                  | .....do.....                          | 67 per cent.            |
| 30/0-31/0....   | .....do.....  | 2 R.....          | 75,000       | 33.00                  | Walter L. Lee.....                    | None.                   |
| <i>Below.</i>   |               |                   |              |                        |                                       |                         |
| 33/0-34/0....   | .....do.....  | 2 R.....          | 50,000       | 28.00                  | .....do.....                          | Do.                     |
| 35/28-37/40.... | .....do.....  | 7 R.....          | 145,000      | 33.00                  | .....do.....                          | 21 per cent.            |
| 42/6-43/10....  | .....do.....  | 13 R.....         | 71,046       | 35.00                  | Walter Lee.....                       | 23 per cent.            |
| 67/45-76/0....  | New work..... | 41-48 R....       | 1,930,000    | 12.24                  | Oglesby Construction Co.              | Annulled Sept. 8, 1917. |
| 67/57-72/12.... | .....do.....  | 41-45 R....       | 930,000      | 24.80                  | Roach, Stansell, Lowrance Bros. & Co. | 36 per cent.            |

The Mississippi County levee district No. 1 contributed \$45,000 on the work put under contract this season, which was their pro rata under the requirements of the flood-control bill approved March 1, 1917.

The Oglesby Construction Co. having failed on their contract for the construction of the Dorena extension from stations 67/45-76/0, the contract under authority of the Chief of Engineers, was annulled September 8, 1917. This work was immediately advertised and a contract entered into with Roach Stansell, Lowrance Bros. & Co., approved by the Chief of Engineers December 8, 1917, for a continuation of the work to the extent that funds were available. The result is shown in the last item of the above table.

The contractor took over the Oglesby tower drag-line machine, which has been doing splendid work, turning out from 60,000 to 65,000 yards per month 10-hour shift, under the new management.

The prevailing shortage of labor has greatly interfered with the progress of all work.

*Condition at the end of fiscal year.*—This levee system completed to the present grade and section will involve an estimated total of 14,294,439 cubic yards, of which 51 per cent was completed at the end of the fiscal year.

There remains to be done 16 miles of extension, involving 4,390,080 cubic yards at the lower end of the system, and 2,655,301 cubic yards of enlargement and banquet construction. Total United States expenditure under the project to the end of the fiscal year was \$1,056,167.57.

*Local cooperation.*—The local authorities have provided to date, in the construction of this levee system, about 2,188,836 cubic yards, at a total cost of \$1,158,283.48.

In addition to the above, the following contribution was made in accordance with the provisions of the flood-control bill approved March 1, 1917: Mississippi County levee district No. 1, \$45,000.

*Effect of improvement.*—Assured protection to about 660 square miles of territory against ordinary floods. As extension and enlargement proceed, an increasing area will be similarly benefited with final and absolute protection of the entire district, 700 square miles, against estimated maximum flood upon the consummation of the project.

*Proposed operations.*—Construction of levee extension and enlargement to the extent and at the rate that funds are made available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

#### Summary of yardage in place.

| Provided by—        | In place May 31, 1917. | Added during year. | In place May 31, 1918. | Under contract May 31, 1918. | Required to complete. |
|---------------------|------------------------|--------------------|------------------------|------------------------------|-----------------------|
|                     | <i>Cu. yds.</i>        | <i>Cu. yds.</i>    | <i>Cu. yds.</i>        | <i>Cu. yds.</i>              | <i>Cu. yds.</i>       |
| United States ..... | 4,384,620              | 877,755            | 5,262,375              | 947,754                      | 7,035,301             |
| Levee boards.....   | 1,996,683              |                    | 1,996,683              |                              |                       |
| Total.....          | 6,381,303              | 877,755            | 7,259,058              | 947,754                      | 7,035,301             |

*Contracts in force.*

| Name of contractor.                       | Amount and character of work (levee work). | Price per unit. | Date of approval. | Date of beginning work. | Date of expiration. | Percentage of completion. |
|-------------------------------------------|--------------------------------------------|-----------------|-------------------|-------------------------|---------------------|---------------------------|
|                                           | <i>Cu. yds.</i>                            | <i>Cents.</i>   |                   |                         |                     |                           |
| L. Leonard.....                           | 122,349                                    | 21.00           | Oct. 25, 1916     | Nov. 9, 1916            | Dec. 31, 1917       | 99.0                      |
| Do.....                                   | 177,435                                    | 21.00           | do.               | do.                     | do.                 | 67.0                      |
| Valter L. Lee.....                        | 75,000                                     | 33.00           | Oct. 11, 1917     | Oct. 29, 1917           | Dec. 31, 1918       |                           |
| Do.....                                   | 50,000                                     | 33.00           | do.               | do.                     | do.                 |                           |
| Do.....                                   | 145,000                                    | 28.00           | do.               | do.                     | do.                 | 21.0                      |
| Valter Lee.....                           | 71,046                                     | 35.00           | Nov. 15, 1917     | Nov. 21, 1917           | do.                 | 23.4                      |
| Roach, Stansell, Lowrance Bros. & Co..... | 930,000                                    | 24.80           | Dec. 8, 1917      | Dec. 28, 1917           | Dec. 31, 1919       | 36.3                      |

*(b) Reelfoot district.*

*Location and description.*—This district is on the left bank of the river, extending from Hickman, Ky., 36 miles below Cairo, to upper Slough Landing Neck, Tenn., about 80 miles below Cairo. The levee system is continuous for a length of 21 miles, and protects about 310 square miles of territory.

*Original condition.*—The United States initiated levee work in the Reelfoot district in 1902. At that time the basin was open, with the exception that local authorities had constructed a levee from the Kentucky-Tennessee State line south to Slough Landing, a distance of about 4½ miles.

*Previous projects.*—None.

*Existing project.*—The original project provided for the construction of a levee from the Hickman Bluffs south to the upstream end of the levee provided prior to 1902 by local authorities and the enlargement of the system to grade and section sufficient to protect the basin against overflow. This project was adopted in 1902. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, 169,347 cubic yards, at a total cost of \$47,018.34. One and three-tenths miles of levee was enlarged to the 1914 Mississippi River Commission grade.

Contracts in force at the beginning of the year and those since executed are given in the following table, which includes the date of completion:

| Location.    | Class. | Miles below Cairo. | Cubic yards. | Price.        | Contractor.                           | Completed.     |
|--------------|--------|--------------------|--------------|---------------|---------------------------------------|----------------|
|              |        |                    |              | <i>Cents.</i> |                                       |                |
| 37-4/36..... | (1)    | 39 L.....          | 102,981      | 16.00         | Roach, Stansell, Lowrance Bros. & Co. | July 31, 1917  |
| 50-16/0..... | (2)    | 50 L.....          | 67,137       | 29.70         | W. E. Bondurant.....                  | Sept. 14, 1917 |

<sup>1</sup> New work.

<sup>2</sup> Enlargement.

The Fulton County Levee Board contributed \$5,000 on the enlargement contract as required under the terms of the flood-control bill approved March 1, 1917.

*Conditions at the end of the fiscal year.*—This levee system completed, to the present grade and section, will involve an estimated total of 4,028,000 cubic yards, of which 72 per cent was completed at the end of the fiscal year.

There remains to be done 1,139,285 cubic yards of enlargement and banquettes work. Total expenditure under this project to the end of the fiscal year, \$395,000.

*Local cooperation.*—Local interests have thus far contributed a total of 61,204 cubic yards, at a cost of \$336,723.90, which includes all cost of actual construction, maintenance, high water expense, charges for right of way, general administration, etc. In addition to the above the local board contributed \$5,000 on work last season under the provisions of the flood-control bill approved March 1, 1917.

*Effect of improvement.*—The construction thus far accomplished affords assured protection from ordinary floods to the entire basin. As the system is

progressively strengthened to completion, increased protection against overflow will be provided.

*Proposed operations.*—Continuation of levee enlargement and banquette construction to the extent and at the rate that funds are made available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Summary of yardage in place.*

| Provided by—       | In place<br>May 31,<br>1917. | Added<br>during<br>year. | In place<br>May 31,<br>1918. | Under<br>contract<br>May 31,<br>1918. | Required<br>to<br>complete |
|--------------------|------------------------------|--------------------------|------------------------------|---------------------------------------|----------------------------|
|                    | <i>Cu. yds.</i>              | <i>Cu. yds.</i>          | <i>Cu. yds.</i>              | <i>Cu. yds.</i>                       | <i>Cu. yds.</i>            |
| United States..... | 1,858,164                    | 170,118                  | 2,028,282                    | .....                                 | } 1,139,282                |
| Levee boards.....  | 861,204                      | .....                    | 861,204                      | .....                                 |                            |
| Total.....         | 2,719,368                    | 170,118                  | 2,889,486                    | .....                                 | 1,139,282                  |

(c) *Lower St. Francis district.*

*Location and description.*—On the right bank of the river from just below New Madrid, Mo., 79 miles below Cairo, to the mouth of the St. Francis River 298 miles below Cairo. Within the limits defined, the lower St. Francis levee is continuous for a length of 211 miles. About 3,500 square miles of territory are protected.

*Original condition.*—When the United States assumed levee interest in the lower St. Francis district there existed along its front detached fragments of levee, constructed by local boards and private land owners, to guard against inflow through the swales and low places along the river bank. This condition had not assumed shape as a levee system and was not expected to resist anything more than "out of bank water."

*Previous projects.*—None.

*Existing project.*—The existing project was adopted in 1887 when 22 miles of levee were provided for, extending from Bear Bayou to Craighead Point, in connection with the improvement of Plum Point Reach. The project contemplated the construction and enlargement of the levees to a grade and section sufficient to protect the basin against overflow. It has been modified from time to time, and at present provides for the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, 1,353,696 cubic yards, at a total cost of \$394,422.57. Ten and four-tenths miles of levee was enlarged, and 6.9 miles of banquette constructed, both to the 1914 Mississippi River Commission grade and section.

Contracts in force at the beginning of the year and those since executed are given in the following table, which includes a statement of the date, or percentage, of completion of each:

| Location.          | Class.                        | Miles<br>below<br>Cairo. | Cubic<br>yards. | Price.        | Contractor.                           | Completed<br>May 31, 1918.  |
|--------------------|-------------------------------|--------------------------|-----------------|---------------|---------------------------------------|-----------------------------|
|                    |                               |                          |                 | <i>Cents.</i> |                                       |                             |
| 41/0-48/4.....     | Banquette....                 | 125 R.....               | 300,000         | 25.00         | Roach, Stansell, Lowrance Bros. & Co. | 60 per cent.                |
| 48/4-49/49.....    | New Work....                  | 130 R.....               | 400,000         | 18.50         | Rodgers Bros.....                     | Completed<br>Oct. 3, 1917.  |
| 83/30-87/14.....   | Enlargement..                 | 175 R.....               | 250,000         | 30.00         | Roach, Stansell, Lowrance Bros. & Co. | None.                       |
| 93/15-96/8.....    | .....do.....                  | 176 R.....               | 180,000         | 25.00         | .....do.....                          | 64 per cent.                |
| 97/20-101/0.....   | .....do.....                  | 188 R.....               | 196,266         | 26.00         | R. L. Leonard.....                    | Completed<br>Oct. 22, 1917. |
| 130/0-140/29.....  | Banquette....                 | 210 R.....               | 798,408         | 29.50         | Roach, Stansell, Lowrance Bros. & Co. | 32 per cent.                |
| 145/6-146/15.....  | Enlargement<br>and banquette. | 225 R.....               | 528,000         | 21.80         | Yale & Reagan.....                    | Completed<br>Dec. 6, 1917.  |
| 146/15-147/8.....  | .....do.....                  | 225 R.....               | 227,8966        | 17.50         | Roach, Stansell, Lowrance Bros. & Co. | 48 per cent.                |
| 157/19-160/0.....  | Enlargement..                 | 247 R.....               | 277,000         | 26.00         | R. L. Leonard.....                    | 63 per cent.                |
| 168/20-169/30..... | .....do.....                  | 250 R.....               | 128,000         | 45.00         | Roach, Stansell, Lowrance Bros. & Co. | 68 per cent.                |
| 171/32-173/0.....  | .....do.....                  | 325 R.....               | 152,000         | 28.00         | H. B. Blanks.....                     | 43 per cent.                |
| 173/0-179/0.....   | .....do.....                  | 253-259 R.....           | 490,000         | 22.00         | .....do.....                          | 14 per cent.                |
| 179/0-180/0.....   | .....do.....                  | 260 R.....               | 106,700         | 30.00         | .....do.....                          | 35 per cent.                |

The Yale & Reagan contract for enlargement and banquette from stratum 146/6 to 146/15, was completed December 6, 1917; that is, the contractor had at that time placed the original estimated yardage, 440,000, plus the 20 per cent as provided for in paragraph 20 of the specifications. The yardage increase over the original estimate was due to a general subsidence of levee foundation which was still in progress when the contractor had fulfilled his contract obligation. The contract was, therefore, terminated and the work continued under a plant rental, and a cost plus a percentage basis (E. D. 98204/9, Nov. 5, 1917), and it is still being prosecuted under that plan. The foundation trouble continues, however, and it is impossible to predict a date of completion.

The shortage of labor is very seriously hindering progress.

Practically all contract work in this district was discontinued in February, last, when the contractor's forces were moved to powder plant construction at Nashville, Tenn., and the nitrate plant construction at Sheffield, Ala. At the time when these forces went away it was expected that they would be gone from 60 to 90 days, but on account of increases made in the original project, the work could not be completed within the estimated time, and upon a presentation of the facts to the Mississippi River Commission on its April inspection trip by a committee representing the contractors, the commission granted them a further leave of absence until July 1, 1918.

The following contributions were made in accordance with the flood-control bill approved March 1, 1917:

|                                           |                |
|-------------------------------------------|----------------|
| Lower St. Francis Levee Board of Missouri | \$22,000       |
| Lower St. Francis Levee Board of Arkansas | 225,500        |
| <b>Total</b>                              | <b>247,500</b> |

*Condition at the end of the fiscal year.*—This levee system completed, to the present grade and section, will involve an estimated total of 52,009,000 cubic yards, of which 87 per cent was completed at the end of the fiscal year. There remains to be done 6,494,744 cubic yards of enlargement and banquette. Total United States expenditure under this project to the end of the fiscal year was \$4,124,695.69.

*Local cooperation.*—The local authorities have provided to date, in the construction of this levee system, about 25,947,931 cubic yards at a total cost of \$10,246,600.39.

In addition to the above, the following contributions were made in accordance with the flood-control bill approved March 1, 1917:

|                                              |                |
|----------------------------------------------|----------------|
| Lower St. Francis levee district of Missouri | \$22,000       |
| Lower St. Francis levee district of Arkansas | 225,500        |
| <b>Total</b>                                 | <b>247,500</b> |

*Effect of improvement.*—Practically the entire basin is protected from overflow against ordinary floods.

*Proposed operations.*—Continuation levee enlargement and banquette construction to the extent and at the rate that funds are made available.

*Recommended modifications of project.*—None.

*Reference to published articles not previously reported.*—None.

#### Summary of yardage in place.

| Provided by—  | In place<br>May 31,<br>1917. | Added<br>during<br>year. | In place<br>May 31,<br>1918. | Under<br>contract<br>May 31,<br>1918. | Required<br>to<br>complete. |
|---------------|------------------------------|--------------------------|------------------------------|---------------------------------------|-----------------------------|
|               | <i>Cu. yds.</i>              | <i>Cu. yds.</i>          | <i>Cu. yds.</i>              | <i>Cu. yds.</i>                       | <i>Cu. yds.</i>             |
| United States | 18,212,629                   | 1,353,696                | 19,566,325                   | 1,817,610                             | 6,494,744                   |
| Levee boards  | 25,656,513                   | 291,418                  | 25,947,931                   |                                       |                             |
| <b>Total</b>  | <b>43,869,142</b>            | <b>1,645,114</b>         | <b>45,514,256</b>            | <b>1,817,610</b>                      | <b>6,494,744</b>            |

*Contracts in force.*

| Name of contractor.                       | Amount and character of work (levee work). | Price unit.            | Date of approval. | Date of beginning work. | Date of expiration. | Percentage of completion. |
|-------------------------------------------|--------------------------------------------|------------------------|-------------------|-------------------------|---------------------|---------------------------|
| Roach, Stansell, Lowrance Bros. & Co..... | <i>Cubic yards.</i><br>300,000             | <i>Cents.</i><br>25.00 | Oct. 9, 1917      | Oct. 25, 1917           | Dec. 31, 1918       | 60.                       |
| Do.....                                   | 250,000                                    | 30.00                  | do.....           | do.....                 | do.....             | 0                         |
| Do.....                                   | 180,000                                    | 25.00                  | do.....           | do.....                 | do.....             | 63.                       |
| Do.....                                   | 798,408                                    | 23.50                  | do.....           | do.....                 | do.....             | 31.                       |
| Do.....                                   | 227,896                                    | 17.50                  | July 14, 1915     | July 24, 1915           | Dec. 31, 1916       | 48.                       |
| R. L. Leonard.....                        | 277,000                                    | 26.00                  | Oct. 9, 1916      | Oct. 24, 1916           | Dec. 31, 1917       | 63.                       |
| Roach, Stansell, Lowrance Bros. & Co..... | 128,000                                    | 45.00                  | Oct. 9, 1917      | Oct. 25, 1917           | Dec. 31, 1918       | 68.                       |
| H. B. Blanks.....                         | 152,000                                    | 28.00                  | Oct. 6, 1917      | do.....                 | do.....             | 43.                       |
| Do.....                                   | 490,000                                    | 22.00                  | Oct. 8, 1917      | do.....                 | do.....             | 14.                       |
| Do.....                                   | 100,700                                    | 30.00                  | Oct. 6, 1917      | do.....                 | do.....             | 35.                       |

*(d) Upper Yazoo district.*

*Location and description.*—This district is on the left bank of the river and comprises the upper end of the State of Mississippi, from 244 to 365 miles below Cairo. The district's area is about 3,281 square miles.

*Original condition.*—The Mississippi River Commission first undertook levee work in this district in 1882, following the disastrous flood of that year. At the time of this flood the Upper Yazoo Levee line was continuous from the Chickasaw Bluffs below Memphis, south for a distance of about 117 miles. The line, however, was largely a coordination of plantation levees ununiform as to grade and section, and described at the time as being merely "up to low grade."

*Previous projects.*—None.

*Existing project.*—The existing project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at date contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

*Operations and results during the fiscal year.*—The United States made no levee expenditures in the Upper Yazoo district during the year.

The levee board added to the system 604,958 cubic yards; total expenditure \$594,965.44.

*Condition at the end of the fiscal year.*—This levee system completed, to the present grade and section, will involve an estimated total of 41,632,000 cubic yards, of which 93 per cent was completed at the end of the fiscal year. There remains to be done 2,920,650 cubic yards of enlargement. Total United States expenditure under the project to the end of the fiscal year, \$1,468,703.45.

*Local cooperation.*—The Upper Yazoo Levee Board has expended to date a total of \$13,560,192.13, which comprehends all cost of construction, maintenance, high-water expenditures, right of way, administration, etc. It does not appear probable that the United States will expend any additional funds on this project.

*Effect of improvement.*—The Upper Yazoo Basin has been made entirely safe against all floods, except, perhaps, the extremest. In the event of the latter vigorous emergency work will, in all likelihood, prevent crevasse of the system or overflow of the basin.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Summary of yardage in place.*

| Provided by—       | In place May 31, 1917. | Added during year. | In place May 31, 1918. | Under contract May 31, 1918. | Required to complete. |
|--------------------|------------------------|--------------------|------------------------|------------------------------|-----------------------|
|                    | <i>Cu. yds.</i>        | <i>Cu. yds.</i>    | <i>Cu. yds.</i>        | <i>Cu. yds.</i>              | <i>Cu. yds.</i>       |
| United States..... | 7,686,756              | .....              | 7,686,756              | .....                        | 2,920,650             |
| Levee boards.....  | 30,419,636             | 604,958            | 31,024,594             | 379,778                      | .....                 |
| Total.....         | 38,106,392             | 604,958            | 38,711,350             | 379,778                      | 2,920,650             |

(c) *White River district.*

*Location and description.*—On the right bank of the river from Helena, Ark., and including a part of Laconia Circle, from 306 to 385 miles below Cairo the area of the basin amounts to 910 square miles.

*Original condition.*—The first expenditure of the United States in the White River district was made in 1887, at which time it is stated that 30 miles of levee "built to low grade" were in existence. These 30 miles presumably comprised a stretch of levee from Helena south, another from the vicinity of Laconia north, and such intermediate plantation levees as were considered to be of any value.

There is no reliable record of the location, or condition of the White River levees at the time in question. It is reported that the entire basin was over-owed in the floods of 1882, 1883 and 1884, but that about 400 square miles were unaffected by the flood of 1886.

*Previous projects.*—None.

*Existing project.*—The existing project is to build and enlarge the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1887. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local boards to the grade and section adopted by the Mississippi River Commission April 19, 1914.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, 635,368 cubic yards, at a total cost of \$217,543. Nine-tenths of a mile of levee was enlarged and 1.7 miles of new levee and banquettes constructed, both to the 1914 Mississippi River Commission grade.

Contracts in force at the beginning of the year and those since executed are given in the following table, which includes a statement of the date, or percentage, of completion of each:

| Location.      | Class.        | Miles below Cairo. | Cubic yards. | Price.        | Contractor.                           | Date of completion and per cent completed May 31, 1918. |
|----------------|---------------|--------------------|--------------|---------------|---------------------------------------|---------------------------------------------------------|
|                |               |                    |              | <i>Cents.</i> |                                       |                                                         |
| 0-28-31/18.... | New work..... | 337 R              | 250,000      | 21.30         | Rodgers Bros.....                     | Sept. 7, 1917.                                          |
| 0-34/0.....    | Enlargement.. | 340 R              | 284,000      | 18.20         | .....do.....                          | Nov. 3, 1917.                                           |
| 0-36/0.....    | .....do.....  | 342 R              | 300,000      | 18.20         | .....do.....                          | Dec. 1, 1917.                                           |
| 0-37/0.....    | .....do.....  | 344 R              | 150,000      | 29.70         | .....do.....                          | 41 per cent.                                            |
| 0-48-53/30.... | New work..... | 370 R              | 260,000      | 40.00         | R. T. Clark & Co.....                 | May 31, 1917.                                           |
| 0-39-62/15.... | .....do.....  | 383 R              | 133,000      | 35.00         | Roach, Stansell, Lowrance Bros. & Co. | Feb. 25, 1918.                                          |

The Laconia levee district No. 1 contributed, under the provisions of the flood-control bill approved March 1, 1917, \$55,000, on the construction of the two loops shown in latter part of the above table.

*Conditions at the end of the fiscal year.*—This levee system, completed to the present grade and section, will involve an estimated total of 28,511,000 cubic yards, of which 59 per cent was completed at the end of the fiscal year. There remains to be done 11,641,045 cubic yards of levee enlargement and banquettes. Total United States expenditure under this project to the end of the fiscal year was \$3,039,883.34.

*Local cooperation.*—The local authorities have provided to date, in the construction of this levee system, about 4,404,438 cubic yards, at a total cost of \$1,890,127.91.

In addition to the above, the Laconia levee district No. 1 contributed \$55,000 under the provision of the flood-control bill approved March 1, 1917.

*Effect of improvement.*—The White River Basin may be assumed to be fully protected only against moderate floods. Increased protection will accrue at the rate and to the extent that future expenditures provide for the increase of grade and section toward the standards established by the Mississippi River Commission.

*Proposed operations.*—Continuation of levee enlargement and banquettes construction to the extent and at the rate that funds are made available.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Summary of yardage in place.*

| Provided by—       | In place<br>May 31,<br>1917. | Placed<br>during<br>year. | In place<br>May 31,<br>1918. | Under<br>contract<br>May 31,<br>1918. | Required<br>to<br>complete. |
|--------------------|------------------------------|---------------------------|------------------------------|---------------------------------------|-----------------------------|
|                    | <i>Cu. yds.</i>              | <i>Cu. yds.</i>           | <i>Cu. yds.</i>              | <i>Cu. yds.</i>                       | <i>Cu. yds.</i>             |
| United States..... | 11,830,149                   | 635,368                   | 12,465,517                   | 94,869                                | 11,641,045                  |
| Levee boards.....  | 4,222,514                    | 181,924                   | 4,404,438                    | .....                                 |                             |
| Total.....         | 16,052,663                   | 217,292                   | 16,869,955                   | 94,869                                | 11,641,045                  |

*Contracts in force.*

| Name of contractor.   | Amount<br>and char-<br>acter of<br>work (levee<br>work). | Price<br>per<br>unit. | Date of<br>approval. | Date of<br>beginning<br>work. | Date of<br>expiration. | Percent-<br>age of<br>completion. |
|-----------------------|----------------------------------------------------------|-----------------------|----------------------|-------------------------------|------------------------|-----------------------------------|
|                       | <i>Cu. yds.</i>                                          | <i>Cents.</i>         |                      |                               |                        |                                   |
| Rodgers Bros.....     | 160,000                                                  | 29.70                 | Oct. 21, 1916..      | Nov. 8, 1916..                | Dec. 31, 1917.         | 40.7                              |
| R. T. Clark & Co..... | 279,315                                                  | 40.00                 | Emergency...         | Oct. 1, 1917...               | Dec. 31, 1918.         | 99.9                              |

## V. SURVEYS.

The annual surveys were made between August 4, 1917, and April 24, 1918. Surveys were made over all existing revetments, consisting of soundings taken on fixed ranges 200 feet apart for comparison with former and future surveys, and bank lines were secured in caving bends, to the end of compiling information as to their future revetments or other requirements.

*Revetment surveys.*—Columbus, Ky. (21 L.); Hickman, Ky. (36 L.); Slough Landing Neck, Tenn. (58–61 L.); New Madrid, Mo. (71 R.); Gayoso Bend, Mo. (106 R.); Caruthersville, Mo. (110 R.); Barfield, Ark. (141 R.); Plum Point Reach, Ark. and Tenn. (147–168 L. and R.); Golden Lake, Ark. (192 R.); Hopefield Bend, Ark. (227 R.); Memphis Harbor, Tenn. (230–232 L.); Norfolk, Miss. (254 L.); Star Landing, Miss. (257 L.); Porter Lake, Ark. (261 R.); Walnut Bend, Ark. (281 R.); Trotters, Miss. (304 L.); Helena, Ark. (306 R.); Delta, Miss. (315 R.); Old Town, Ark. (324 R.); Sunflower, Miss. (355 L.).

*Bank line surveys.*—Lucas Bend, Mo. (14–18 R.); Beckwiths Bend, Mo. (30–33 R.); Hickman Bend, Ky. (35–41 L.); bend of Island 8, Mo. (44–50 R.); Slough Landing Neck, Tenn., Ky., and Mo. (58–70 L. and R.); New Madrid Bend Mo., and Point Pleasant Reach, Mo. (70–85 R.); Stewarts Landing, Mo. (90–93 R.); Bells Point, Mo. (112 R.); foot of Island 17, Mo. (118–120 R.); Huffman, Ark. (128–133 R.); chute of Island 26, Tenn. (147–153 L.); Ashport Bar, Mo. (153–157 R.); chute of Island 30, Tenn. (157–162 L.); bend of Island 35, Ark. (187–196 R.); St. Claire, Ark. (220–223 L.); Old Hen Island, Tenn. (224–225 L.); Hopefield Point, Ark., to Wyanoke, Ark. (230–240 R.); Graves Bayou, Ark., to Cat Island, Ark. (250–254 R.); Mhoons Bend, Miss. (275–280 L.); Fox Island Bend, Miss. (285–290 L.); Hardins Point, Ark. (290–291 R.); O. K. Bend, Miss. (291–295 L.); St. Francis Bend, Ark. (293–298 R.); Friar's Point, Miss. (317–320 L.); Dawson, Ark., to Offuts, Ark. (343–346 R.); Sunflower Bend, Miss. (357–360 L.); Laconia, Ark. (377–379 R.).

## VI. PLANT.

*Operations during the fiscal year.*

*New plant.*—The following items of plant were added during the year at the costs indicated:

|                                                                                                                                                                                   |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Nos. 1701 to 1707, inclusive, creosoted, wooden material barges under construction at the time that last annual report was submitted; completed during the year at a cost of..... | \$1,881.77 |
| Nos. 1708 and 1709, creosoted, wooden flats under construction at the time that last annual report was submitted; completed during the year at a cost of.....                     | 413.35     |

|                                                                                                                                                                                                                            |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| ss. 1711 to 1713, inclusive, creosoted, wooden concrete mattress barges (under construction). Construction cost during the year                                                                                            | \$7,398.00             |
| ss. 1714 to 1719, creosoted, wooden sand barges (under construction). Construction cost during the year                                                                                                                    | 32,606.01              |
| b. 1801, hydraulic sand and gravel digger (under construction). Construction cost during the year                                                                                                                          | 872.58                 |
| ss. 1 and 2, dipper dredge (by purchase)                                                                                                                                                                                   | \$55,000.00            |
| ss. 1 and 2, dump scows (by purchase)                                                                                                                                                                                      | 10,000.00              |
|                                                                                                                                                                                                                            | <sup>1</sup> 65,000.00 |
| ss. 5, 6, and 7, skiffs (by purchase)                                                                                                                                                                                      | 120.00                 |
| Tools and appliances, outfits, etc                                                                                                                                                                                         | 14,207.54              |
| Unexpended material on hand                                                                                                                                                                                                | 58,600.68              |
| Total                                                                                                                                                                                                                      | 181,099.93             |
| <i>Plant decreased.</i> —The plant has been decreased during the year by the following items:                                                                                                                              |                        |
| Dropped on affidavit: Model barge No. 214, decked barges Nos. 9315 and 9325, steamer <i>Minnetonka</i> , steamer <i>Graham</i> , hydraulic grader No. 1022, quarterboat No. 206, skiffs Nos. 13 and 14.                    |                        |
| To be dropped on affidavit: Model barges Nos. 131 and 135, decked barges Nos. 1008 and 1703, mooring barge No. 1.                                                                                                          |                        |
| <i>Repairs to plant.</i> —Repairs to the following items of plant have been made during the year at the costs indicated:                                                                                                   |                        |
| Steamer <i>Minnetonka</i> : Hull received minor repairs and was calked several times to prevent sinking (sunk during the year; property salvaged)                                                                          | \$1,875.99             |
| Steamer <i>Wynoka</i> : Three new rudders, ice cans, and brine tank expansion coils purchased; new ice box built; furnace walls rebuilt; repairs to pitman, wheel, steam capstan, and steam lines; general running repairs | 4,562.29               |
| Steamer <i>Chisca</i> : New exhaust pipe built and installed; repairs to pumps, nigger boiler, steam capstan, doctor, fantail and rudders; general running repairs                                                         | 875.29                 |
| Steamer <i>Graham</i> : New stacks built and installed; feed pumps repaired; new wheel stock built; general running repairs (sunk during the year)                                                                         | 763.25                 |
| Steamer <i>Search</i> : Roof renewed; fantail and guards repaired; machinery and stoves overhauled; general running repairs                                                                                                | 1,431.07               |
| Steamer <i>Itasca</i> : Repairs to capstan, rudders, towing fenders, feed pump, steam line, wheel, and roof; furnace walls rebuilt and machinery repaired; general running repairs                                         | 567.38                 |
| Steamer <i>Augustus J. Nolty</i> : Head log rebuilt twice, new wrist pin built and installed; new tow and swinging fenders built; air pump rebushed; machinery repaired; general running repairs (sunk and hull recovered) | 1,250.00               |
| Steamer <i>W. M. Rees</i> : Repairs to boiler breeching, feed and condenser pump, cylinder head, wheel, and fantail; general running repairs                                                                               | 975.09                 |
| Steamer <i>Maud Kilgore</i> : Repairs to wheel; general running repairs                                                                                                                                                    | 475.00                 |
| Steamer <i>Mercury</i> : Repairs to wheel, rudders, pitmans, and capstans; general running repairs                                                                                                                         | 275.00                 |
| Steamer <i>Saturn</i> : Repairs to boiler room bulkhead                                                                                                                                                                    | 125.00                 |
| Dredge <i>Iota</i> : New stretcher bars built; repairs to feed pump and boilers                                                                                                                                            | 175.00                 |
| Dredge <i>Kappa</i> : New stretcher bars built; repairs to feed pumps, main pump, pontoon chains, valves, sheaves, and cables and pontoons                                                                                 | 225.00                 |
| Dredge <i>Gamma</i> : Minor repairs to machinery                                                                                                                                                                           | 79.40                  |
| Dredge <i>Zeta</i> : New fire tools built                                                                                                                                                                                  | 33.20                  |
| Hydraulic grader No. 1022: New set of repair parts for pump purchased (sunk during the year)                                                                                                                               | 971.85                 |
| Hydraulic grader No. 1205: Toilet room and bathroom installed; new stage plank built; repairs to machinery, boilers, and breeching; new set of repair parts for pumps purchased                                            | 2,486.62               |

<sup>1</sup> Paid for from allotment for Memphis Harbor.

|                                                                                                                                                                                                                                                                                              |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Hydraulic grader No. 1401: New pump plungers built; minor repairs to machinery; new set of parts purchased for pumps-----                                                                                                                                                                    | \$1, 275. 45 |
| Sand and gravel digger No. 1407: Rakes calked; cabin repaired; boiler and machinery overhauled; discharge water box repaired and calked-----                                                                                                                                                 | 412. 50      |
| Concrete mixing plant No. 1208: New sand chute, bumper, and new elevator pivot shaft built; repairs made to boom and boiler house. New sprockets and elevator buckets purchased; machinery overhauled; docked on dredge fleet ways and hull scraped and painted-----                         | 1, 958. 11   |
| Derrick boat No. 3: Guards and rakes repaired and calked; new steam pipe installed; boom repaired and fitted with new cable---                                                                                                                                                               | 375. 50      |
| Derrick boat No. 1017: Installed new piston rods on hoist; feed pump overhauled-----                                                                                                                                                                                                         | 164. 00      |
| Derrick boat No. 1411: Guards repaired and calked; rakes calked; machinery overhauled; boom repaired and new cable put on; general running repairs-----                                                                                                                                      | 735. 00      |
| Pile driver No. 4: Received minor repairs to cabin-----                                                                                                                                                                                                                                      | 18. 40       |
| Northern No. 2: Boom, dipper, and dipper handle received extensive repairs-----                                                                                                                                                                                                              | 1, 720. 00   |
| Machine shop No. 1: Guards, sides, and rakes repaired and calked; new stack and new furnace walls built; repairs made to boiler feed pump and machinery from time to time-----                                                                                                               | 625. 62      |
| Boiler shop No. 0806: Rakes repaired and calked; boiler repaired and flues rolled; repairs made to air compressor at various times-----                                                                                                                                                      | 175. 00      |
| Floating dock: Gates and valves repaired-----                                                                                                                                                                                                                                                | 192. 00      |
| Locomotive crane: Flues renewed in boiler; driving gears repaired; general repairs-----                                                                                                                                                                                                      | 875. 50      |
| Creosote tanks: Tanks repaired; heating pipes taken out and refitted; old boiler repaired; new boiler installed and a new boiler house erected; minor repairs-----                                                                                                                           | 325. 28      |
| Launch Opelika: New toilet installed; cabin screened; docked three times and hull repaired and painted; propellers and shafts taken out and straightened; machinery overhauled; shaft boxes, timing gears, and piston rings repaired; new propellers purchased; general running repairs----- | 1, 825. 00   |
| Coal loader No. 9309: Received minor repairs to deck-----                                                                                                                                                                                                                                    | 3. 15        |
| Quarterboat No. 2: Received minor repairs to cabin-----                                                                                                                                                                                                                                      | 74. 70       |
| Quarterboat No. 3: Received repairs to roof-----                                                                                                                                                                                                                                             | 45. 40       |
| Quarterboat No. 5: Received minor repairs to cabin-----                                                                                                                                                                                                                                      | 36. 20       |
| Quarterboat No. 6: Renewed pump valves and suckers; minor repairs-----                                                                                                                                                                                                                       | 75. 20       |
| Storeboat No. 8: Sides and rakes repaired and calked; guards and deck repaired and calked; new floor laid in office-----                                                                                                                                                                     | 353. 65      |
| Storeboat No. 12: Sides and rakes repaired and calked; deck repaired; new timberheads put in-----                                                                                                                                                                                            | 123. 00      |
| Quarterboat No. 25: Repairs made to side of hull-----                                                                                                                                                                                                                                        | 72. 00       |
| Carpenter shop boat No. 26: Sides and rakes repaired and calked; new capstans and timberheads installed; minor repairs-----                                                                                                                                                                  | 179. 20      |
| Quarterboat No. 27: Ice box rebuilt; stoves and ranges, stove pipes, and plumbing overhauled-----                                                                                                                                                                                            | 235. 40      |
| Quarterboat No. 0601: Docked; old part of hull rebuilt; deck and cabin repaired-----                                                                                                                                                                                                         | 975. 75      |
| Quarterboat No. 206: Repairs to stoves and ranges; rakes and guards calked; sunk during year-----                                                                                                                                                                                            | 238. 50      |
| Quarterboat No. 221: Received repairs to stoves and ranges; rakes, sides, guards, and deck repaired and calked-----                                                                                                                                                                          | 175. 00      |
| Quarterboat No. 1020: Stoves and ranges repaired; portable bulkhead built in dining room; cabin and deck repaired-----                                                                                                                                                                       | 163. 45      |
| Quarterboat No. 1021: Stoves and ranges overhauled; rakes calked-----                                                                                                                                                                                                                        | 75. 00       |
| Quarterboat No. 1301: Stoves, ranges, and cabin carlins repaired; cabin interior changed; plumbing overhauled-----                                                                                                                                                                           | 786. 63      |
| Quarterboat No. 1402: Stoves, ranges, and cabin carlins repaired; new fenders installed; rakes calked-----                                                                                                                                                                                   | 727. 75      |
| Scow dump No. 1: Docked; bottom, rakes, and sides repaired and calked; deck and mud pockets repaired-----                                                                                                                                                                                    | 275. 30      |

|                                                                     |          |
|---------------------------------------------------------------------|----------|
| W dump No. 2: Docked; bottom, rakes, and sides repaired and         |          |
| alked; deck and mud pockets repaired                                | \$275.34 |
| ge mattress No. 1501: Repairs made to platform and ways             | 135.00   |
| ge mattress No. 1502: Repairs made to platforms and fingers         | 105.25   |
| ge mooring No. 1223: Boiler repaired to install on barge            | 325.50   |
| ge model No. 128: Docked; bottom, sides, and heads patched          |          |
| nd calked                                                           | 225.00   |
| ge model No. 137: Docked; bottom, sides and heads patched           |          |
| nd calked                                                           | 300.00   |
| ge No. 0802: Docked; end rebuilt, bottom repaired; both rakes       |          |
| alked                                                               | 271.30   |
| ge No. 0903: Rakes calked afloat                                    | 2.10     |
| ge No. 1001: Rakes calked afloat                                    | 75.00    |
| ge No. 1002: Rakes patched and calked afloat                        | 34.35    |
| ge No. 1004: Deck house extended over full length of barge;         |          |
| akes calked and patched                                             | 479.88   |
| ge No. 1005: Rakes calked afloat                                    | 60.00    |
| ge No. 1008: Sunk; material assembled for raising barge started     |          |
| nd stopped by high water                                            | 490.25   |
| ge No. 1101: Docked; bottom and rakes calked                        | 72.30    |
| ge No. 1202: Docked; hull scraped and painted                       | 76.42    |
| ge No. 1209: Docked; hull scraped and painted                       | 81.75    |
| ge No. 1217: Hole in side patched                                   | 15.20    |
| ge No. 1219: Docked; hull scraped and painted                       | 120.00   |
| ge No. 1220: Rakes calked afloat                                    | 18.00    |
| ge No. 1302: Sides patched and calked                               | 98.20    |
| ge No. 1304: Rakes patched and calked                               | 47.00    |
| ge No. 1306: Rakes calked afloat                                    | 67.20    |
| ge No. 1308: Rakes patched and calked afloat                        | 65.62    |
| ge No. 1317: Docked; rake repaired; hull scraped and painted        | 395.40   |
| ge No. 1406: Rakes repaired and calked                              | 260.00   |
| ge No. 1409: Rake patched                                           | 14.20    |
| ks: General repairs                                                 | 75.00    |
| ing flat No. 1: Rebuilt                                             | 75.00    |
| ellaneous: Repairs were made to tools and appliances at vari-       |          |
| s times for construction parties, and fleet use; repairs to ranges, |          |
| oves, wheelbarrows, pumps, and furniture                            | 1,275.95 |

|                      |           |
|----------------------|-----------|
| Total                | 37,977.44 |
| air material on hand | 1,855.18  |

|               |           |
|---------------|-----------|
| Total repairs | 39,832.62 |
|---------------|-----------|

The following shows the original cost, the repair, and depreciation during year, and the present estimated value of all plants employed in the first and second Mississippi River Commission districts:

| Name.   | No. | Original cost. | Valuation last year. | Repairs. | Deprecia-<br>tion. | Present<br>esti-<br>mated<br>value. |
|---------|-----|----------------|----------------------|----------|--------------------|-------------------------------------|
| model:  |     |                |                      |          |                    |                                     |
| 122     | 1   | \$3,847.00     | \$1,330.43           |          | \$230.81           | \$1,099.62                          |
| 126     | 1   | 2,885.00       | 1,326.90             |          | 173.10             | 1,153.80                            |
| 128     | 1   | 3,590.00       | 1,284.60             | \$225.00 | 215.40             | 1,294.20                            |
| 131     | 1   | 3,590.00       | 1,284.60             |          | 1,284.60           | (1)                                 |
| 133     | 1   | 3,650.00       | 1,456.38             |          | 219.00             | 1,237.38                            |
| 134     | 1   | 3,650.00       | 1,281.00             |          | 219.00             | 1,062.00                            |
| 135     | 1   | 3,650.00       | 1,281.00             |          | 1,281.00           | (1)                                 |
| 137     | 1   | 3,650.00       | 1,281.00             | 300.00   | 219.00             | 1,362.00                            |
| 212     | 1   | 3,800.00       | 1,272.00             |          | 228.00             | 1,044.00                            |
| 214     | 1   | 3,597.00       | 1,296.71             |          | 1,296.71           | (1)                                 |
| 216     | 1   | 3,597.00       | 1,284.18             |          | 215.82             | 1,068.36                            |
| 217     | 1   | 3,597.00       | 1,284.18             |          | 215.82             | 1,068.36                            |
| decked: |     |                |                      |          |                    |                                     |
| 9309    | 1   | 3,170.00       | 3,454.07             | 3.15     | 190.20             | 3,267.02                            |
| 9315    | 1   | 3,170.00       |                      |          |                    | (2)                                 |
| 9318    | 1   | 3,170.00       | 2,715.70             |          | 190.20             | 2,525.50                            |
| 9319    | 1   | 3,170.00       |                      |          |                    | (3)                                 |
| 9325    | 1   | 2,466.67       |                      |          |                    | (2)                                 |

Sunk; will be dropped by affidavit.

2 Sunk; dropped by affidavit.

3 Worthless.

| Name.                           | No. | Original cost. | Valuation last year. | Repairs. | Depreciation. | Present estimate value |
|---------------------------------|-----|----------------|----------------------|----------|---------------|------------------------|
| <b>Barge, decked—Continued.</b> |     |                |                      |          |               |                        |
| No. 9327                        | 1   | \$2,466.66     | \$2,183.38           |          | \$148.00      | \$2,035.38             |
| No. 0801                        | 1   | 5,727.53       | 2,945.59             |          | 286.38        | 2,651.21               |
| No. 0802                        | 1   | 5,727.53       | 2,854.49             | \$271.30 | 286.38        | 2,833.89               |
| No. 0803                        | 1   | 5,727.53       | 3,030.69             |          | 286.38        | 2,744.82               |
| No. 0804                        | 1   | 5,727.53       | 2,884.99             |          | 286.38        | 2,595.22               |
| No. 0805                        | 1   | 3,531.50       | 903.43               |          | 176.58        | 722.45                 |
| No. 0807                        | 1   | 5,624.70       | 1,581.40             |          | 281.24        | 1,300.16               |
| No. 0808                        | 1   | 5,624.70       | 1,522.45             |          | 281.24        | 1,243.21               |
| No. 0809                        | 1   | 5,624.70       | 1,597.60             |          | 281.24        | 1,316.36               |
| No. 0811                        | 1   | 5,727.53       | 2,854.21             |          | 286.38        | 2,567.83               |
| No. 0901                        | 1   | 5,569.58       | 2,917.18             |          | 278.48        | 2,633.92               |
| No. 0903                        | 1   | 5,569.58       | 2,944.04             | 2.10     | 278.48        | 2,666.06               |
| No. 1001                        | 1   | 4,242.00       | 2,907.21             | 75.00    | 212.10        | 2,770.11               |
| No. 1002                        | 1   | 4,242.00       | 2,794.85             | 34.35    | 212.10        | 2,615.00               |
| No. 1003                        | 1   | 4,242.00       | 2,803.25             |          | 212.10        | 2,590.15               |
| No. 1004                        | 1   | 4,242.00       | 3,295.96             | 479.88   | 212.10        | 3,568.74               |
| No. 1005                        | 1   | 4,050.00       | 2,903.89             | 60.00    | 202.50        | 2,760.39               |
| No. 1006                        | 1   | 4,050.00       | 2,829.47             |          | 202.50        | 2,626.97               |
| No. 1007                        | 1   | 4,246.58       | 3,019.11             |          | 212.33        | 2,807.78               |
| No. 1008                        | 1   | 4,246.58       | 2,932.61             | 490.25   | 3,422.86      | (1)                    |
| No. 1009                        | 1   | 4,246.58       | 3,603.70             |          | 212.33        | 3,391.37               |
| No. 1010                        | 1   | 4,246.58       | 2,935.77             |          | 212.33        | 2,723.44               |
| No. 1011                        | 1   | 4,246.58       | 2,993.66             |          | 212.33        | 2,781.33               |
| No. 1012                        | 1   | 4,246.58       | 2,929.57             |          | 212.33        | 2,717.24               |
| No. 1101                        | 1   | 4,300.00       | 3,261.55             | 72.30    | 215.00        | 3,114.25               |
| <b>Barge, steel:</b>            |     |                |                      |          |               |                        |
| No. 1201                        | 1   | 8,900.00       | 7,568.37             |          | 356.00        | 7,212.37               |
| No. 1202                        | 1   | 8,900.00       | 6,937.13             | 76.42    | 356.00        | 6,655.71               |
| No. 1203                        | 1   | 8,900.00       | 7,016.34             |          | 356.00        | 6,660.34               |
| No. 1204                        | 1   | 8,900.00       | 6,975.99             |          | 356.00        | 6,619.99               |
| No. 1206                        | 1   | 8,900.00       | 7,006.63             |          | 356.00        | 6,650.63               |
| No. 1207                        | 1   | 8,900.00       | 6,978.73             |          | 356.00        | 6,622.73               |
| No. 1209                        | 1   | 8,900.00       | 6,953.74             | 81.75    | 356.00        | 6,677.49               |
| No. 1210                        | 1   | 8,900.00       | 7,076.12             |          | 356.00        | 6,722.12               |
| No. 1212                        | 1   | 8,900.00       | 6,765.62             |          | 356.00        | 6,409.62               |
| No. 1213                        | 1   | 8,900.00       | 6,765.62             |          | 356.00        | 6,409.62               |
| No. 1214                        | 1   | 8,900.00       | 7,045.62             |          | 356.00        | 6,689.62               |
| <b>Barge, decked:</b>           |     |                |                      |          |               |                        |
| No. 1215                        | 1   | 4,194.00       | 3,181.67             |          | 209.70        | 2,971.97               |
| No. 1216                        | 1   | 4,194.00       | 3,320.87             |          | 209.70        | 3,111.17               |
| No. 1217                        | 1   | 4,194.00       | 3,074.57             | 15.20    | 209.70        | 2,880.07               |
| No. 1218                        | 1   | 4,194.00       | 3,148.70             |          | 209.70        | 2,939.00               |
| No. 1219                        | 1   | 4,194.00       | 3,017.15             | 120.00   | 209.70        | 2,927.15               |
| No. 1220                        | 1   | 4,194.00       | 3,093.45             | 18.00    | 209.70        | 2,905.75               |
| No. 1221                        | 1   | 4,194.00       | 3,104.03             |          | 209.70        | 2,894.33               |
| No. 1302                        | 1   | 4,773.15       | 3,706.23             | 98.20    | 238.66        | 3,569.83               |
| No. 1303                        | 1   | 4,773.15       | 3,579.87             |          | 238.66        | 3,341.21               |
| No. 1304                        | 1   | 4,773.15       | 3,661.78             | 47.00    | 238.66        | 3,424.12               |
| No. 1305                        | 1   | 4,773.15       | 4,094.16             |          | 238.66        | 3,855.50               |
| No. 1306                        | 1   | 4,773.15       | 3,621.08             | 67.20    | 238.66        | 3,445.22               |
| <b>Barge, steel:</b>            |     |                |                      |          |               |                        |
| No. 1307                        | 1   | 8,500.00       | 6,931.17             |          | 340.00        | 6,591.17               |
| No. 1308                        | 1   | 8,500.00       | 6,918.36             | 65.62    | 340.00        | 6,643.74               |
| No. 1309                        | 1   | 8,500.00       | 6,909.00             |          | 340.00        | 6,569.00               |
| No. 1310                        | 1   | 8,500.00       | 7,018.35             |          | 340.00        | 6,678.35               |
| No. 1314                        | 1   | 8,500.00       | 6,909.00             |          | 340.00        | 6,569.00               |
| No. 1315                        | 1   | 8,500.00       | 6,909.00             |          | 340.00        | 6,569.00               |
| No. 1316                        | 1   | 8,500.00       | 7,033.71             |          | 340.00        | 6,693.71               |
| No. 1317                        | 1   | 8,500.00       | 6,909.00             | 395.40   | 340.00        | 6,909.00               |
| No. 1318                        | 1   | 8,500.00       | 6,909.00             |          | 340.00        | 6,569.00               |
| <b>Barge, decked:</b>           |     |                |                      |          |               |                        |
| No. 1403                        | 1   | 4,500.00       | 3,740.83             |          | 225.00        | 3,515.83               |
| No. 1404                        | 1   | 4,500.00       | 3,838.88             |          | 225.00        | 3,613.88               |
| No. 1405                        | 1   | 4,500.00       | 4,084.24             |          | 225.00        | 3,859.24               |
| No. 1406                        | 1   | 4,500.00       | 3,708.57             | 200.00   | 225.00        | 3,743.57               |
| No. 1408                        | 1   | 4,500.00       | 3,749.51             |          | 225.00        | 3,524.51               |
| No. 1409                        | 1   | 4,500.00       | 3,699.87             | 14.20    | 225.00        | 3,484.87               |
| No. 1410                        | 1   | 4,500.00       | 3,838.35             |          | 225.00        | 3,613.35               |
| No. 1701                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| No. 1702                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| No. 1703                        | 1   | 4,830.00       | 4,830.00             |          | 4,830.00      | (1)                    |
| No. 1704                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| No. 1705                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| No. 1706                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| No. 1707                        | 1   | 4,830.00       | 4,830.00             |          | 241.50        | 4,588.50               |
| <b>Barge, mattress:</b>         |     |                |                      |          |               |                        |
| No. 5                           | 1   | 4,530.00       | 2,790.14             |          | 226.50        | 2,563.64               |
| No. 6                           | 1   | 4,530.00       | 2,739.63             |          | 226.50        | 2,513.13               |
| No. 9308                        | 1   | 2,800.00       | 5,264.66             |          | 140.00        | 5,124.66               |

<sup>1</sup> Sunk; to be dropped by affidavit.

| Name.                          | No. | Original cost. | Valuation last year. | Repairs. | Depreciation. | Present estimated value. |
|--------------------------------|-----|----------------|----------------------|----------|---------------|--------------------------|
| e, mattress—Continued.         |     |                |                      |          |               |                          |
| No. 9312                       | 1   | \$2,800.00     | \$3,442.77           |          | \$140.00      | \$5,302.77               |
| No. 0701                       | 1   | 5,120.00       | 3,838.37             |          | 306.00        | 3,532.37                 |
| No. 0703                       | 1   | 5,120.00       | 4,073.15             |          | 306.00        | 3,767.15                 |
| No. 1018                       | 1   | 4,642.91       | 3,334.99             |          | 232.15        | 3,102.84                 |
| No. 1019                       | 1   | 4,642.91       | 3,334.43             |          | 232.15        | 3,102.28                 |
| No. 1501                       | 1   | 6,992.03       | 6,676.31             | \$135.00 | 349.60        | 6,461.71                 |
| No. 1502                       | 1   | 6,992.02       | 6,614.17             | 105.25   | 349.60        | 6,369.82                 |
| e, mooring:                    |     |                |                      |          |               |                          |
| No. 1                          | 1   | 2,023.00       | 537.05               |          | 537.05        | (1)                      |
| No. 2                          | 1   | 2,023.00       | 491.04               |          | 121.38        | 369.66                   |
| No. 1222                       | 1   | 3,560.00       | 2,463.97             |          | 178.00        | 2,285.97                 |
| No. 1223                       | 1   | 3,780.00       | 2,599.71             | 325.50   | 189.00        | 2,736.21                 |
| No. 1224                       | 1   | 3,560.00       | 2,503.65             |          | 178.00        | 2,325.65                 |
| No. 1225                       | 1   | 3,780.00       | 2,642.11             |          | 189.00        | 2,453.11                 |
| e, flat:                       |     |                |                      |          |               |                          |
| No. 4                          | 1   | 460.00         | 293.67               |          | 23.03         | 270.64                   |
| No. 5                          | 1   | 499.80         | 377.02               |          | 22.99         | 354.03                   |
| No. 1311                       | 1   | 743.04         | 569.66               |          | 37.15         | 532.51                   |
| No. 1312                       | 1   | 743.04         | 575.47               |          | 37.15         | 538.32                   |
| No. 1313                       | 1   | 743.04         | 580.90               |          | 37.15         | 543.75                   |
| No. 1708                       | 1   | 992.00         | 992.00               |          | 49.60         | 942.40                   |
| No. 1709                       | 1   | 992.00         | 992.00               |          | 49.60         | 942.40                   |
| e, boat:                       |     |                |                      |          |               |                          |
| No. 3                          | 1   | 2,956.00       | 5,253.63             | 375.50   | 147.80        | 5,481.33                 |
| No. 1017                       | 1   | 5,959.40       | 4,263.52             | 114.00   | 297.97        | 4,129.55                 |
| No. 1411                       | 1   | 8,481.70       | 8,103.54             | 735.00   | 424.09        | 8,414.45                 |
| e, boat:                       |     |                |                      |          |               |                          |
| No. 2                          | 1   | 5,200.00       | 2,688.00             | 74.70    | 312.00        | 2,450.70                 |
| No. 3                          | 1   | 5,200.00       | 2,688.00             | 45.40    | 312.00        | 2,421.40                 |
| No. 5                          | 1   | 5,200.00       | 2,845.16             | 36.20    | 312.00        | 2,569.36                 |
| No. 6                          | 1   | 5,200.00       | 2,713.50             | 75.20    | 312.00        | 2,476.70                 |
| No. 8                          | 1   | 3,645.00       | 2,648.13             | 353.65   | 218.70        | 2,783.08                 |
| No. 11                         | 1   | 3,645.00       | 1,434.84             |          | 1,434.84      | (3)                      |
| No. 12                         | 1   | 3,645.00       | 3,381.42             | 125.00   | 218.70        | 3,287.72                 |
| No. 25                         | 1   | 3,645.00       | 1,093.71             | 72.00    | 1,165.71      | (3)                      |
| No. 26                         | 1   | 3,645.00       | 3,397.56             | 179.20   | 218.70        | 3,368.06                 |
| No. 27                         | 1   | 2,788.00       | 4,022.78             | 235.40   | 139.40        | 4,118.78                 |
| No. 29                         | 1   | 2,741.00       | 1,268.65             |          | 164.46        | 1,104.19                 |
| No. 206                        | 1   | 4,900.00       | 3,475.31             | 238.50   | 3,713.81      | (1)                      |
| No. 221                        | 1   | 4,900.00       | 3,897.65             | 175.00   | 294.00        | 3,778.65                 |
| No. 0601                       | 1   | 3,059.00       | 2,112.63             | 975.72   | 152.95        | 2,935.40                 |
| No. 1020                       | 1   | 9,889.11       | 6,206.67             | 163.45   | 494.46        | 5,875.66                 |
| No. 1021                       | 1   | 9,889.11       | 6,058.80             | 75.00    | 494.46        | 5,639.34                 |
| No. 1301                       | 1   | 5,800.00       | 4,375.19             | 786.63   | 290.00        | 4,871.82                 |
| No. 1402                       | 1   | 10,349.94      | 7,845.42             | 727.79   | 520.00        | 8,053.21                 |
| e, public grader:              |     |                |                      |          |               |                          |
| No. 2                          | 1   | 30,232.00      | (4)                  | (4)      | (4)           | (4)                      |
| No. 1022                       | 1   | 15,900.00      | 11,985.97            | 971.85   | 12,957.82     | (1)                      |
| No. 1205                       | 1   | 31,721.07      | 30,383.44            | 2,486.62 | 1,288.84      | 31,661.22                |
| No. 1401                       | 1   | 32,802.63      | 28,988.58            | 1,275.48 | 1,224.14      | 29,039.92                |
| Grader No. 1407                | 1   | 13,445.00      | 11,652.14            | 412.51   | 672.25        | 11,392.40                |
| Concrete mixing plant No. 1208 | 1   | 25,000.00      | 37,960.88            | 1,958.11 | 1,315.60      | 38,633.39                |
| Coaling dock                   | 1   | 9,475.00       | 591.53               | 192.05   | 568.50        | 215.08                   |
| Boat shop No. 1                | 1   | 8,501.00       | 9,571.19             | 625.64   | 510.00        | 9,586.77                 |
| Boat No. 4                     | 1   | 4,500.00       | 1,534.34             | 18.40    | 270.00        | 1,282.74                 |
| e, boats:                      |     |                |                      |          |               |                          |
| Annetonka                      | 1   | 40,000.00      | 24,217.34            | 1,875.99 | 26,093.33     | (1)                      |
| Wynoka                         | 1   | 45,672.00      | 20,964.08            | 4,562.29 | 1,926.88      | 23,599.49                |
| Wisca                          | 1   | 25,900.00      | 27,910.69            | 875.29   | 1,554.00      | 27,231.98                |
| Waham                          | 1   | 9,500.00       | 20,988.03            | 763.25   | 21,751.28     | (1)                      |
| Wahch                          | 1   | 9,000.00       | 11,761.53            | 1,431.07 | 540.00        | 12,652.60                |
| Wahca                          | 1   | 9,500.00       | 9,527.39             | 567.38   | 380.00        | 9,714.77                 |
| Augustus J. Nolty              | 1   | 34,735.00      | 31,744.46            | 1,250.00 | 13,994.46     | \$ 19,000.00             |
| M. M. Rees                     | 1   | 34,735.00      | 32,637.84            | 975.09   | 1,389.40      | 32,223.53                |
| And Kilgore                    | 1   | (6)            |                      | 475.00   | 475.00        |                          |
| Creury                         | 1   | (7)            |                      | 275.00   | 275.00        |                          |
| Turn                           | 1   | (7)            |                      | 125.00   | 125.00        |                          |
| Dredge, Northern No. 2         | 1   | 55,000.00      | 55,000.00            | 1,720.00 | 1,650.00      | 55,070.00                |
| e, boats:                      |     |                |                      |          |               |                          |
| No. 1                          | 1   | (1)            |                      | 175.00   | 175.00        |                          |
| No. 2                          | 1   | (1)            |                      | 225.00   | 225.00        |                          |
| No. 3                          | 1   | (1)            |                      | 79.40    | 79.40         |                          |
| No. 4                          | 1   | (1)            |                      | 33.20    | 33.20         |                          |

1 Sunk; dropped by affidavit.

2 Unserviceable; to be dropped by affidavit.

3 Worthless.

4 Worthless; to be dropped by I. and I. report.

5 Sunk and hull recovered with some of the machinery.

6 Chartered.

7 Borrowed.

| Name.                                      | No.   | Original cost. | Valuation last year. | Repairs.   | Depreciation. | Present estimated value. |
|--------------------------------------------|-------|----------------|----------------------|------------|---------------|--------------------------|
| Launch Opelika.....                        | 1     | \$5,000.00     | \$10,061.14          | \$1,825.00 | \$810.00      | \$11,076.14              |
| Scows, dump:                               |       |                |                      |            |               |                          |
| No. 1.....                                 | 1     | 5,000.00       | 5,000.00             | 275.34     | 250.00        | 5,024.66                 |
| No. 2.....                                 | 1     | 5,000.00       | 5,000.00             | 275.34     | 250.00        | 5,024.66                 |
| Boiler shop No. 0806.....                  | 1     | 3,531.51       | 973.07               | 175.00     | 211.89        | 977.69                   |
| Skiffs.....                                | 25    | 910.00         | 680.73               | 75.00      | 43.50         | 771.23                   |
| Calking flat No. 1.....                    | 1     | 20.00          | 77.20                | 75.00      | 1.20          | 171.00                   |
| Boats:                                     |       |                |                      |            |               |                          |
| Metallic.....                              | 3     | 180.00         | 142.80               | .....      | 7.20          | 172.60                   |
| Life.....                                  | 2     | 170.00         | 134.87               | .....      | 6.80          | 163.07                   |
| Creosote tanks.....                        | 2     | 1,347.37       | 880.82               | 325.28     | 53.89         | 1,168.00                 |
| Locomotive crane.....                      | 1     | 7,125.00       | 6,193.23             | 875.50     | 1,187.50      | 5,805.73                 |
| Concrete revetment plant (dismantled)..... | 1     | 12,163.00      | 163.00               | .....      | .....         | 11,999.00                |
| Tools and appliances.....                  | ..... | 46,668.43      | 31,898.75            | 1,275.95   | 4,666.84      | 28,535.89                |
| Repair material on hand.....               | ..... | .....          | .....                | 1,855.18   | .....         | 1,855.18                 |
| Total.....                                 | ..... | 1,174,271.03   | 897,999.13           | 39,832.62  | 145,518.56    | 792,320.92               |

*Care of plant.*—All the plant employed in these districts was suitably cared for during the year at Memphis, Tenn., at a total expense of \$38,330.

#### Recapitulation.

|                       |           |
|-----------------------|-----------|
| New plant.....        | \$181,099 |
| Repairs to plant..... | 39,832    |
| Care of plant.....    | 38,330    |
| Total.....            | 259,261   |

#### Contracts in force.

| Name of contractor.                                          | Amount and character of work.                | Price per unit. | Date of approval. | Date of beginning work. | Date of completion. |
|--------------------------------------------------------------|----------------------------------------------|-----------------|-------------------|-------------------------|---------------------|
| G. W. Fisher <sup>1</sup> .....                              | Rent of river front at Government fleet.     | 2 \$50.00       | June 15, 1917     | July 1, 1917            | June 30, 1918       |
| Chas. H. Boyle <sup>1</sup> .....                            | do.....                                      | 50.00           | do.....           | do.....                 | Do.                 |
| Mrs. Jennie Astor and husband, W. B. Astor. <sup>1</sup>     | Rent of land near Government fleet.          | 100.00          | do.....           | do.....                 | Do.                 |
| St. Louis-San Francisco Ry. Co. <sup>1</sup>                 | do.....                                      | 125.00          | June 18, 1917     | do.....                 | Do.                 |
| Memphis Steel Construction Co. of Pennsylvania. <sup>2</sup> | Constructing and delivering one steel barge. | 23,400.00       | Jan. 21, 1918     | Feb. 14, 1918           | Do.                 |

<sup>1</sup> Lease.

<sup>2</sup> Per annum.

<sup>3</sup> Contract: Percentage of completion, 3.

#### INCLOSURES.

The following inclosures accompany this report, of which they are parts:

Plate No. 1. First and second districts, index map.

Plate No. 2. Columbus, Ky.

Plate No. 3. Hickman, Ky., and bend of Island No. 8, Mo.

Plate No. 4. Slough Landing Neck, New Madrid, Mo., and Point Pleasant Reach.

Plate No. 5. Gayoso Bend and Caruthersville, Mo.

Plate No. 6. Barfield, Ark.

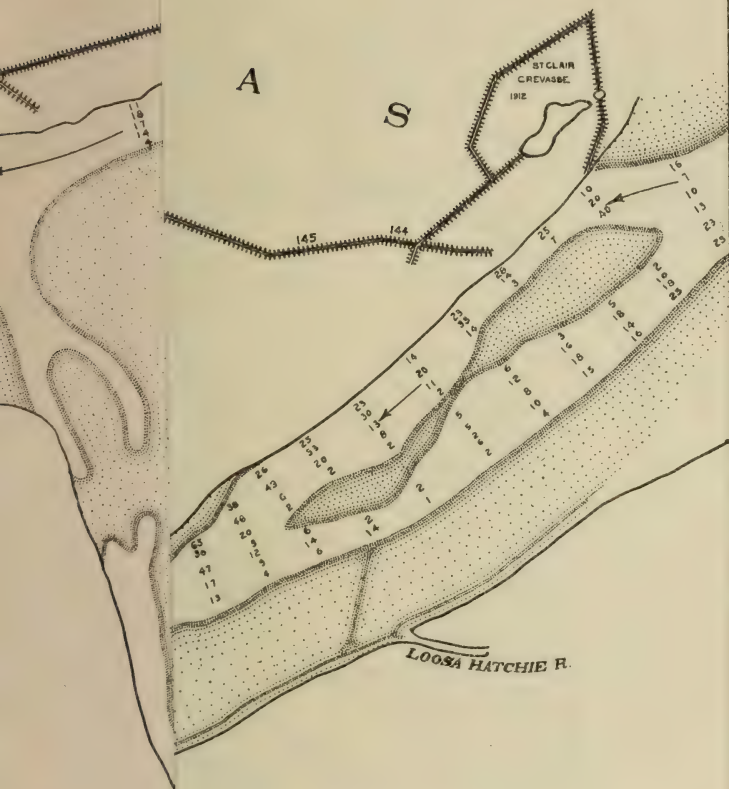
Plate No. 7. Plum Point Reach, chute of Island No. 26, Daniels Point, Port Bend, Gold Dust, Tenn., Fletcher's Bend, Osceola Front, Ark., and Button Bar, Ark.

Plate No. 8. Golden Lake, Ark.

Plate No. 9. Memphis Reach, Hopefield Point, Memphis Harbor, Tennessee Chute.

Plate No. 10. Norfolk and Star Landing, Miss., and Porter Lake, Ark.

Plate No. 11. Walnut Bend, Ark.



MISSISSIPPI RIVER  
MEMPHIS REACH  
SURVEY OF APRIL 1918

IN ONE SHEET

SHEET NO. 1

SCALE OF FEET

0 1000 8000

DISTRICTS MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN. JUNE 1918

SUBMITTED BY

APPROVED

## LEGEND

SHORE LINE 1917

SHORE LINE 1918

REVELMENT

SOUNDINGS REDU

FILE No. 34

27

JR. ENGR.

ASST ENGR. IN CHARGE

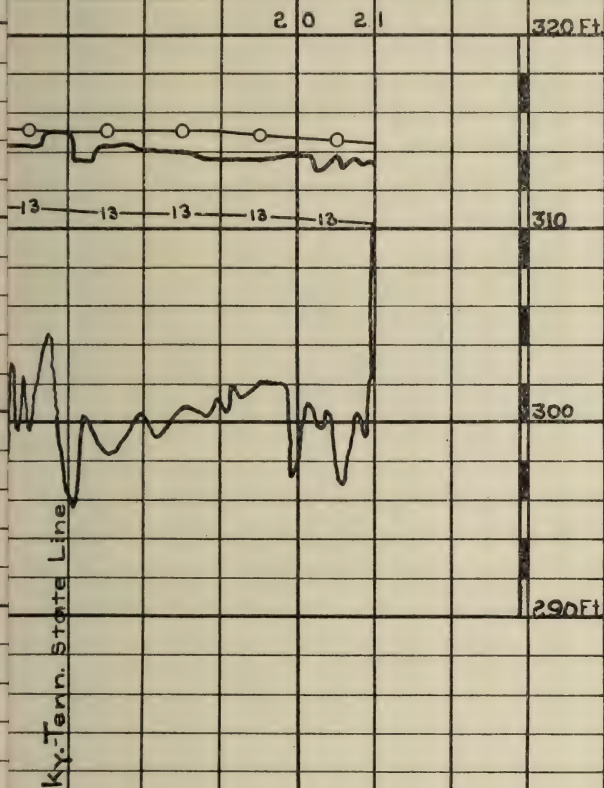
TO ACCOMPANY

ANNUAL REPORT 1917-18.



## MISSISSIPPI RIVER COMMISSION

Plate No. 17



# MISSISSIPPI RIVER REELFOOT LEVEE DISTRICT

IN ONE SHEET

SHEET No. 1

SCALE OF FEET

HOR. 0 5000 10000 VERT. 0 1 2 3 4 5

DISTRICTS MISSISSIPPI RIVER COMMISSION OFFICE

MEMPHIS, TENN. MAY 1918

BY

SUBMITTED BY

APPROVED

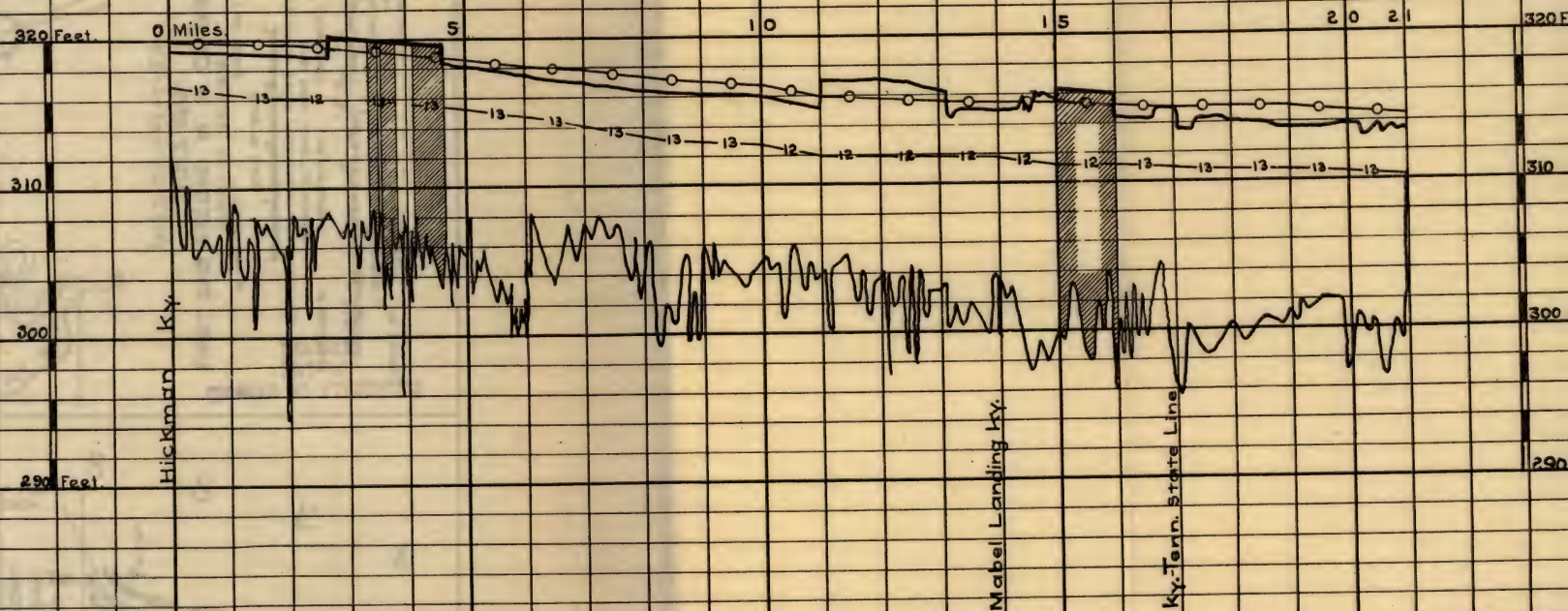
*Chief Engineer*  
 ENGR. ASST. ENGR. ASST. ENGR. IN CHARGE

FILE NO.

TO ACCOMPANY

34/27

ANNUAL REPORT 1917 18



## LEGEND

- Established Com. Grade
- |- High Water 1912
- |- High Water 1913
- ▨ Built by U.S. 1917-18
- ▨ Enlarged by U.S. 1917-18

MISSISSIPPI RIVER  
REELFOOT LEVEE DISTRICT

IN ONE SHEET SHEET NO. 1

SCALE OF FEET

HOR. 1" = 1000' VERT. 1" = 10'

1ST & 2ND DISTRICTS MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN. MAY 1918

PREPARED BY

SUBMITTED BY

APPROVED

*R.B. Brier* *Wm. H. Montgomery*  
 JR. ENGR. ASST. ENGR. ASST. ENGR. IN CHARGE  
 TO ACCOMPANY  
 ANNUAL REPORT 1917-18

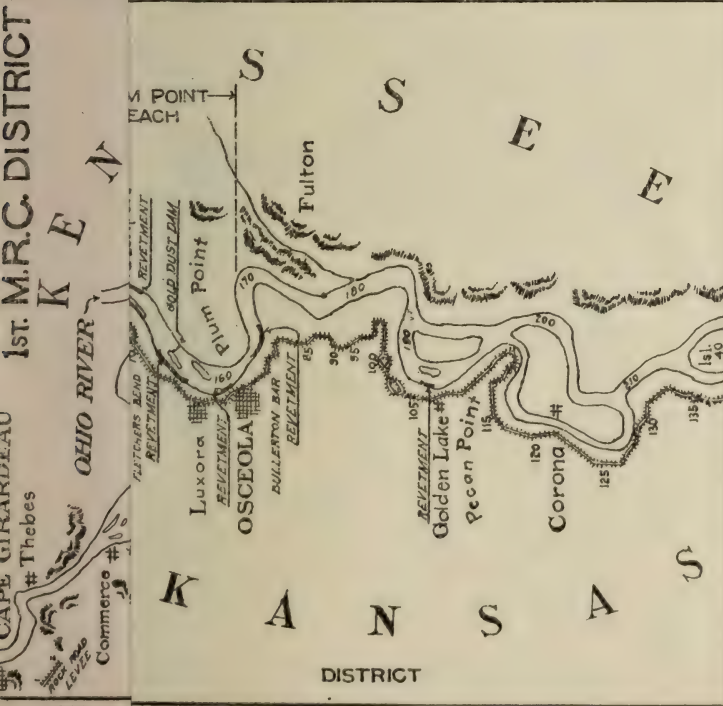
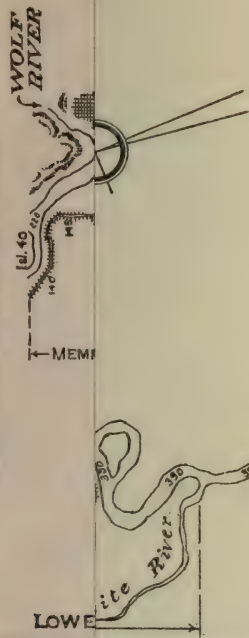
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 B.A.C. 34/27

1st. M.R.C. DISTRICT

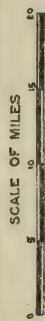
CAPE GIRARDEAU  
# Thebes  
# Commerce #10

2ND M.R.C. DISTRICT

PLATE NO.



MISSISSIPPI RIVER  
INDEX MAP  
FIRST AND SECOND M.R.C. DISTRICTS  
SURVEY OF 1917-1918  
IN ONE SHEET SHEET NO. 1



1st & 2nd DISTRICTS, MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN., JUNE 1918

PREPARED BY SUBMITTED BY APPROVED

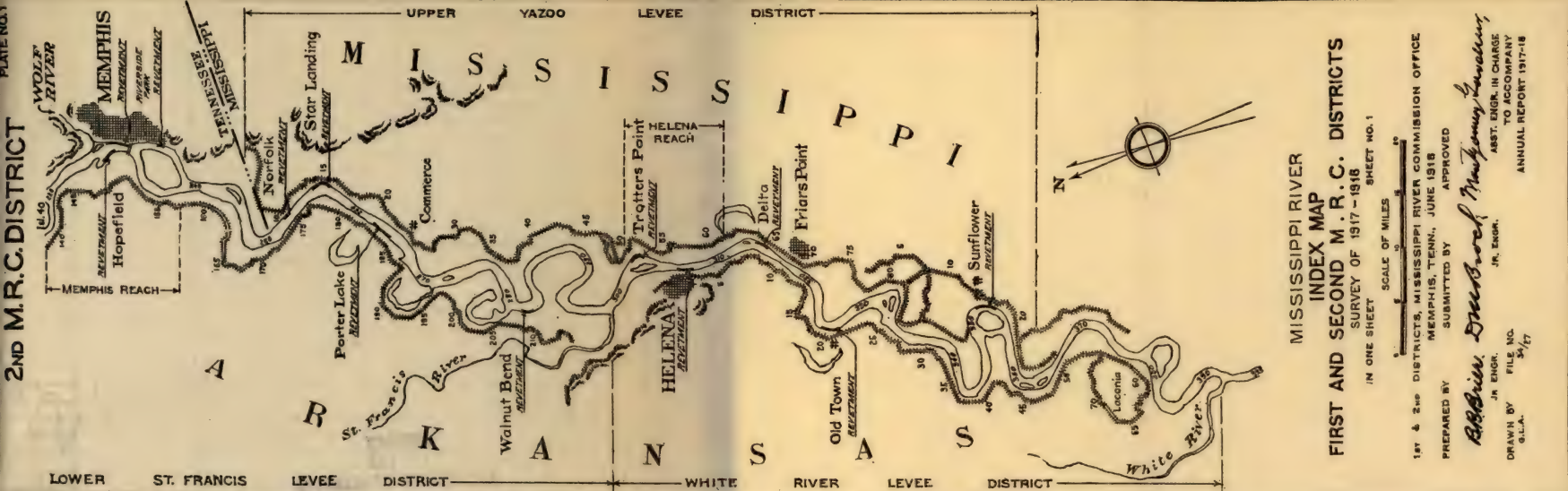
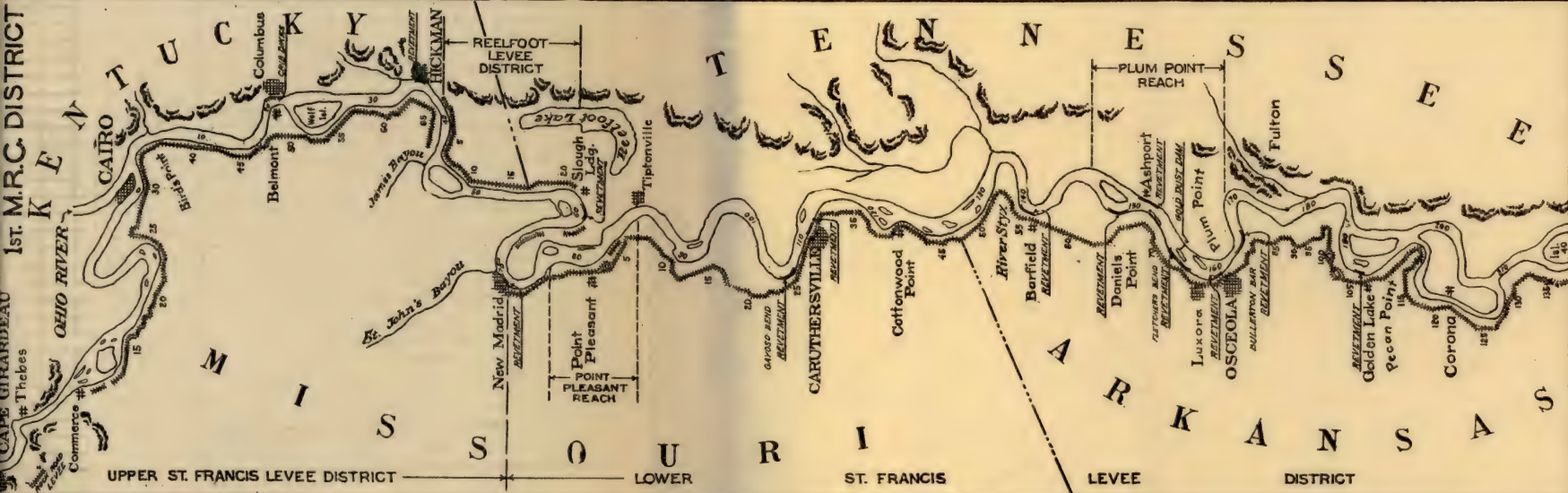
*R. B. Brin, Dan Brock, Montgomery Lovelace*  
JR. ENGR.

ASST. ENGR. IN CHARGE

TO ACCOMPANY

ANNUAL REPORT 1917-18

DRAWN BY FILE NO.  
G.L.A. 34167



MISSISSIPPI RIVER

INDEX MAP

FIRST AND SECOND M.R.C. DISTRICTS

SURVEY OF 1917-1918

IN ONE SHEET

SCALE OF MILES  
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1st & 2nd DISTRICTS, MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN., JUNE 1918

PREPARED BY

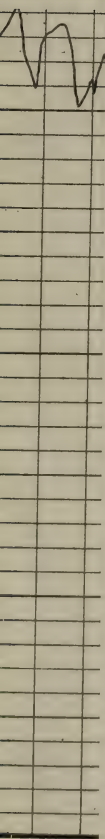
SUBMITTED BY

APPROVED

ASST. ENGR. IN CHARGE

TO ACCOMPANY

ANNUAL REPORT 1917-18





MISSISSIPPI RIVER  
INDEX MAP  
FIRST AND SECOND M. R. C. DISTRICTS  
SURVEY OF 1917-1918

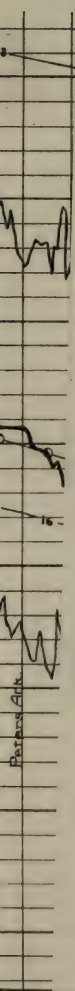
IN ONE SHEET

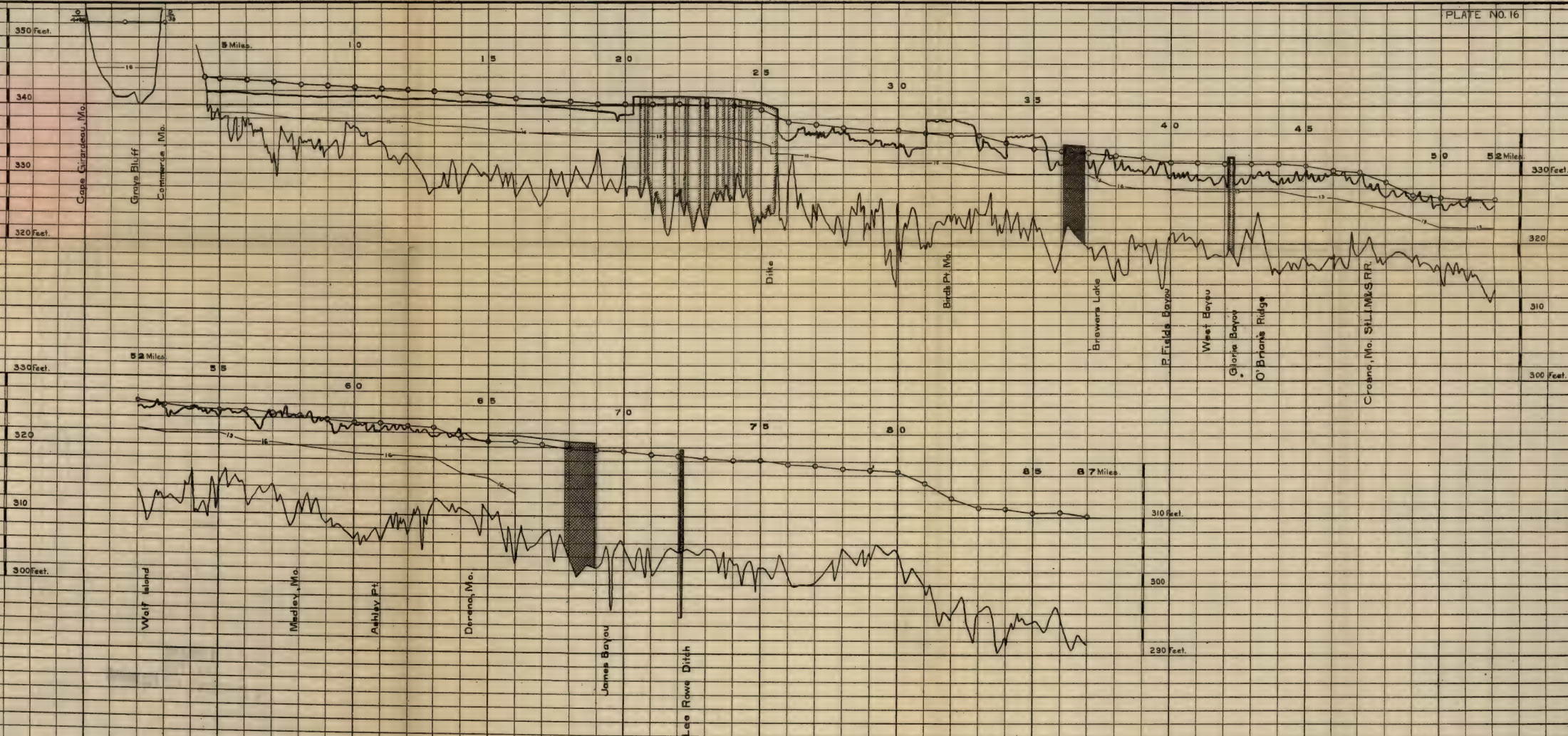
A horizontal scale bar with markings at 0, 5, 10, 15, and 20 miles. The text "SCALE OF MILES" is written vertically along the left side of the scale.

1ST & 2ND DISTRICTS, MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN., JUNE 1918

SUBMITTED BY APPROVED

DRAWN BY *JR ENGR.* FILE NO. *3417*  
*R.B. Brinn. Duesbrook, Newbury, Lancashire, ENGL.*  
 ASST. ENGR. IN CHARGE  
 TO ACCOUNT  
 ANNUAL REPORT 1917-18





MISSISSIPPI RIVER  
UPPER ST. FRANCIS LEVEE DISTRICT  
IN ONE SHEET SHEET NO. 1

LEGEND

- Estimated Commission Grade
- Highest Water
- Levee
- Build by U.S. 1871-18
- Enlarged by U.S. 1871-18
- Build by U.S. & Local Authorities 1871-18
- Enlarged by U.S. & Local Authorities 1871-18

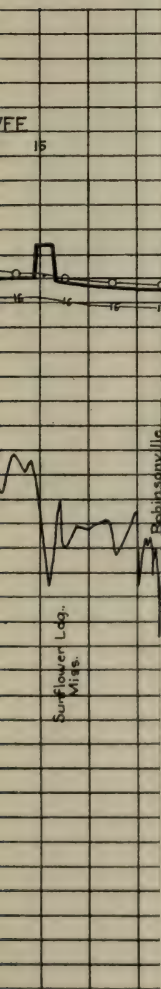
PREPARED BY  
SUBMITTED BY  
APPROVED BY  
DRAWN BY  
FILE NO.  
ANNUAL REPORT 1871-18

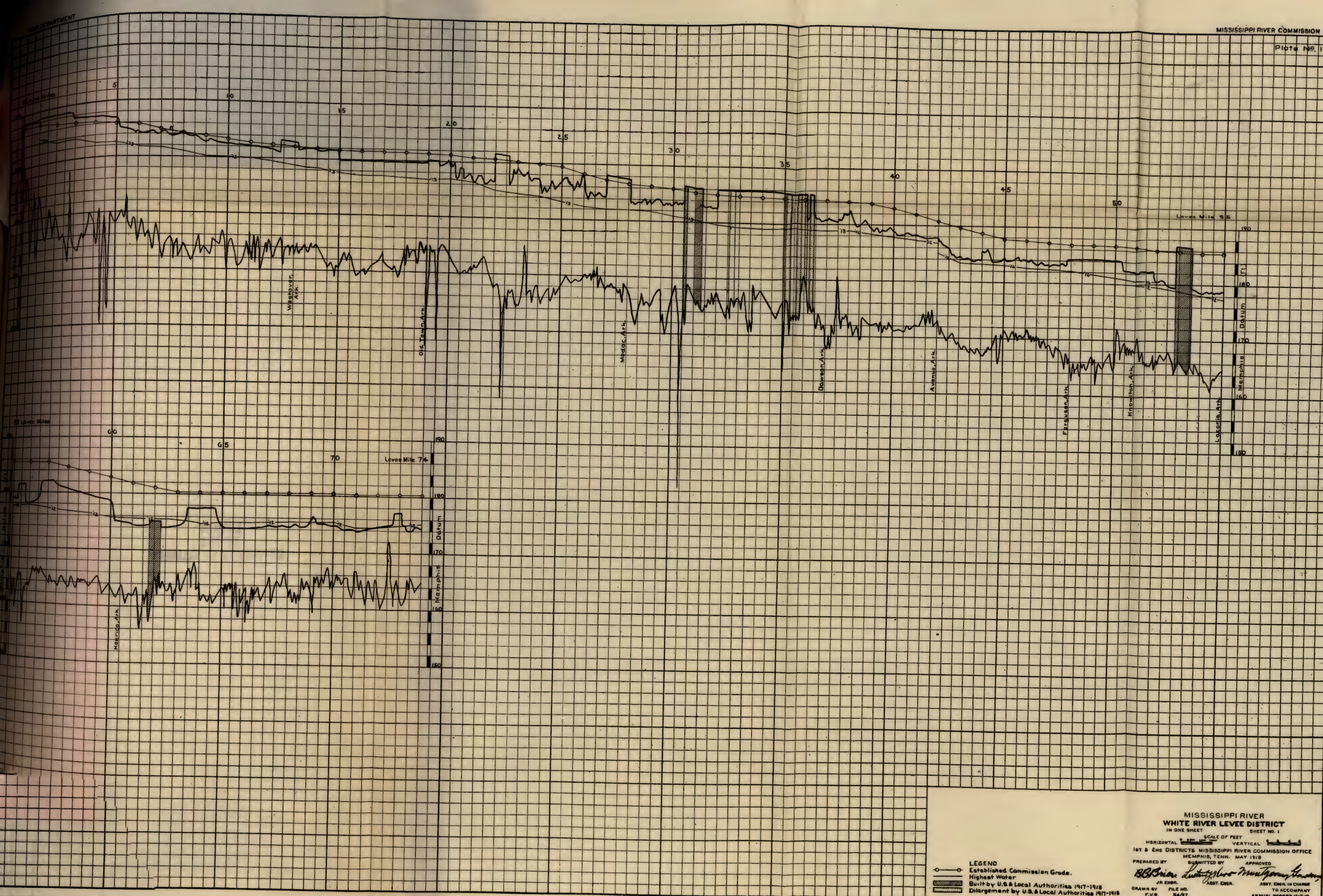
1st & 2nd DISTRICTS MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN. JUNE 1878

1878









MISSISSIPPI RIVER  
WHITE RIVER LEVEE DISTRICT  
IN ONE SHEET SHEET NO. 1

HORIZONTAL SCALE OF FEET  
1" = 100'

VERTICAL SCALE OF FEET  
1" = 10'

1ST & 2ND DISTRICTS MISSISSIPPI RIVER COMMISSION OFFICE  
MEMPHIS, TENN. MAY 1918

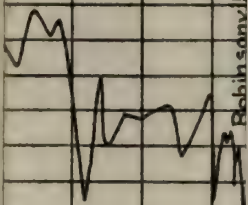
PREPARED BY J.R. EISER  
DRAWN BY J.R. EISER  
FILE NO. 34/27

SUBMITTED BY B.C. Brier  
APPROVED BY J.R. EISER  
TO ACCOMPANY ANNUAL REPORT 1917-18

LEGEND  
Established Commission Grade.  
Highest Water.  
Built by U.S. & Local Authorities 1917-1918  
Enlargement by U.S. & Local Authorities 1917-1918

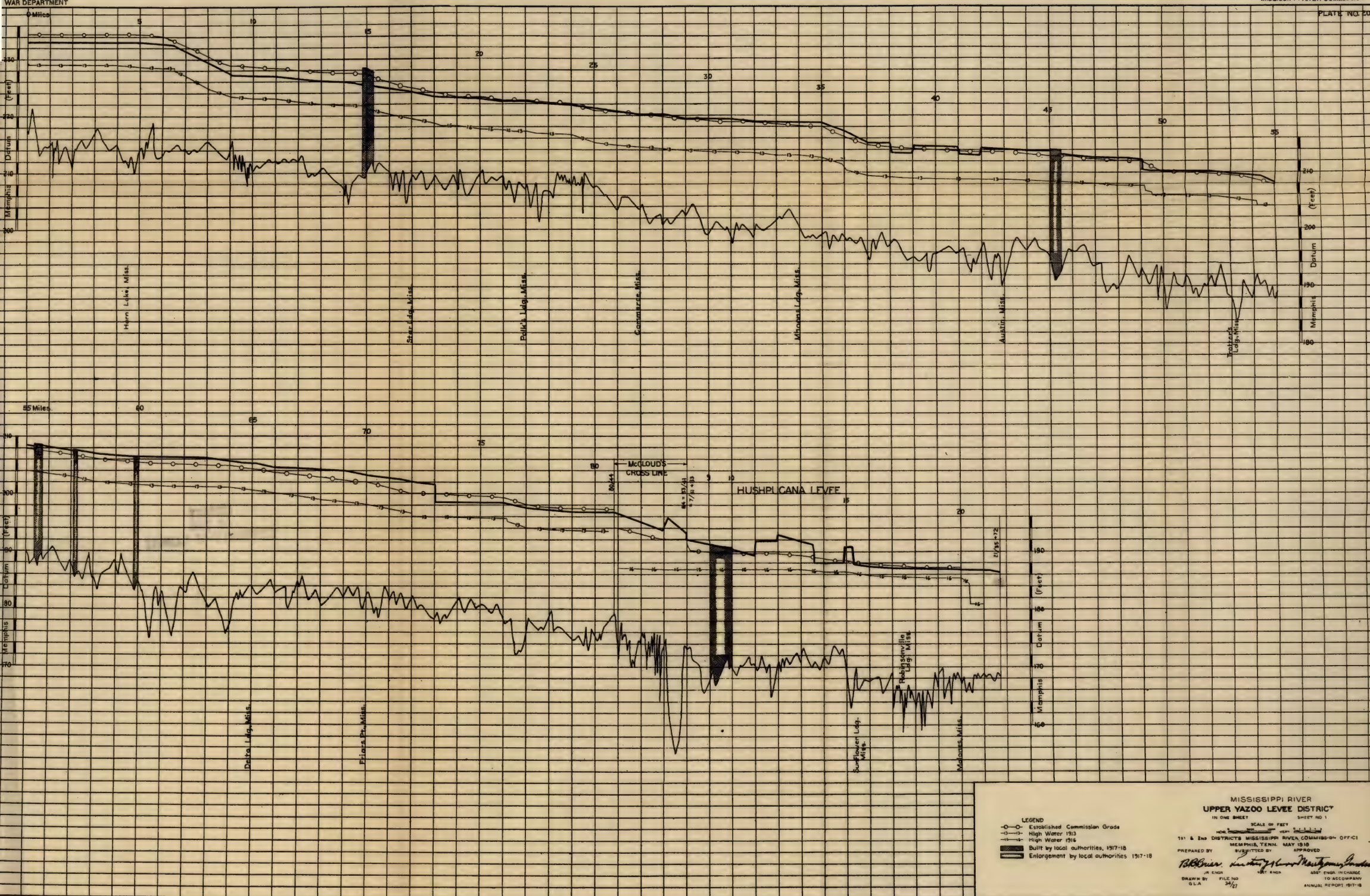
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15



Sunflower Ldg.  
Miss.

Robinsonville



- Plate No. 12. Helena Reach, Trotters Revetment, Helena Revetment.  
Plate No. 13. Delta, Miss.  
Plate No. 14. Old Town, Ark.  
Plate No. 15. Sunflower, Miss.  
Plate No. 16. Upper St. Francis levee district.  
Plate No. 17. Reelfoot levee district.  
Plate No. 18. Lower St. Francis levee district.  
Plate No. 19. White River levee district.  
Plate No. 20. Upper Yazoo levee district.

Money statements and abstract of contracts in force follow.

MONTGOMERY GARDNER,  
*Assistant Engineer in Charge.*

## Abstract of contracts in force June 30, 1918.

| Names of contractors.                                    | Amount and character of work.                               | Rate per cubic yard. | Date of approval. | Date of beginning work. | Date of expiration of contract. | Percentage completed June 30, 1918. |
|----------------------------------------------------------|-------------------------------------------------------------|----------------------|-------------------|-------------------------|---------------------------------|-------------------------------------|
| <i>Upper St. Francis levee district.</i>                 |                                                             |                      |                   |                         |                                 |                                     |
| R. L. Leonard.....                                       | 122,349 cubic yards levee work, stations 20/16-22/0.....    | Cents.<br>21.00      | Oct. 25, 1916     | Nov. 9, 1916            | Dec. 31, 1917                   | 1 239.0                             |
| Do.....                                                  | 187,935 cubic yards levee work, stations 24/0-25/15.....    | 21.00                | do.....           | do.....                 | do.....                         | 1 71.0                              |
| Walter L. Lee.....                                       | 75,000 cubic yards levee work, stations 30/0-31/0.....      | 33.00                | Oct. 11, 1917     | Oct. 29, 1917           | Dec. 31, 1918                   | 00.0                                |
| Do.....                                                  | 50,000 cubic yards levee work, stations 33/0-34/0.....      | 33.00                | do.....           | do.....                 | do.....                         | 00.0                                |
| Do.....                                                  | 145,000 cubic yards levee work, stations 35/28-37/40.....   | 28.00                | do.....           | do.....                 | do.....                         | 28.0                                |
| Do.....                                                  | 71,045 cubic yards levee work, stations 42/5-43/10.....     | 35.00                | Nov. 15, 1917     | Nov. 21, 1917           | do.....                         | 30.0                                |
| Roach, Stansell, Lowrance Bros. & Co.....                | 330,000 cubic yards levee work, stations 67/57-72/12.....   | 24.80                | Dec. 8, 1917      | Dec. 28, 1917           | Dec. 31, 1919                   | 45.0                                |
| <i>Lower St. Francis levee district.</i>                 |                                                             |                      |                   |                         |                                 |                                     |
| Roach, Stansell, Lowrance Bros. & Co.....                | 300,000 cubic yards levee work, stations 41/0-48/4.....     | 25.00                | Oct. 9, 1917      | Oct. 25, 1917           | Dec. 31, 1918                   | 2 60.0                              |
| Do.....                                                  | 250,000 cubic yards levee work, stations 83/30-87/14.....   | 30.00                | do.....           | do.....                 | do.....                         | 00.0                                |
| Do.....                                                  | 180,000 cubic yards levee work, stations 93/15-96/8.....    | 25.00                | do.....           | do.....                 | do.....                         | 2 63.9                              |
| Do.....                                                  | 798,408 cubic yards levee work, stations 130/0-140/29.....  | 29.50                | do.....           | do.....                 | do.....                         | 2 31.8                              |
| Do.....                                                  | 227,896 cubic yards levee work, stations 145/15-147/8.....  | 17.50                | July 14, 1915     | July 24, 1915           | Dec. 31, 1916                   | 1 248.5                             |
| R. L. Leonard.....                                       | 277,000 cubic yards levee work, stations 157/19-160/0.....  | 23.00                | Oct. 9, 1916      | Oct. 24, 1916           | Dec. 31, 1917                   | 1 66.8                              |
| Roach, Stansell, Lowrance Bros. & Co.....                | 128,000 cubic yards levee work, stations 168/20-169/30..... | 45.00                | Oct. 9, 1917      | Oct. 25, 1917           | Dec. 31, 1918                   | 2 68.0                              |
| H. B. Banks.....                                         | 152,000 cubic yards levee work, stations 171/32-173/0.....  | 28.00                | Oct. 6, 1917      | do.....                 | do.....                         | 45.3                                |
| Do.....                                                  | 480,000 cubic yards levee work, stations 173/0-179/0.....   | 22.00                | Oct. 8, 1917      | do.....                 | do.....                         | 2 14.0                              |
| Do.....                                                  | 103,700 cubic yards levee work, stations 179/0-180/0.....   | 30.00                | Oct. 6, 1917      | do.....                 | do.....                         | 2 35.0                              |
| <i>White River levee district.</i>                       |                                                             |                      |                   |                         |                                 |                                     |
| Rodgers Bros.....                                        | 160,000 cubic yards levee work, stations 36/0-37/0.....     | 29.70                | Oct. 21, 1916     | Nov. 8, 1916            | Dec. 31, 1917                   | 1 240.7                             |
| R. T. Clark & Co.....                                    | 279,315 cubic yards levee work, stations 52/48-53/30.....   | 40.00                | Emergency..       | Oct. 1, 1917            | Dec. 31, 1918                   | 3 100.0                             |
| <i>Leases and contract for constructing steel barge.</i> |                                                             |                      |                   |                         |                                 |                                     |
| G. W. Fisher.....                                        | Rent of river front at Memphis, Tenn.....                   | 4 \$50.00            | Lease.....        | July 1, 1917            | June 30, 1918                   | .....                               |
| Chas. H. Boyle.....                                      | do.....                                                     | 50.00                | do.....           | do.....                 | do.....                         | .....                               |
| Mrs. Jennie Astor and husband, W. B. Astor.....          | Rent of land near Government fleet.....                     | 400.00               | do.....           | do.....                 | do.....                         | .....                               |
| St. Louis-San Francisco Ry. Co.....                      | do.....                                                     | 125.00               | do.....           | do.....                 | do.....                         | .....                               |
| Memphis Steel Construction Co. of Pennsylvania.....      | Constructing and delivering one steel barge.....            | 23,400.00            | Jan. 21, 1918     | Feb. 14, 1918           | do.....                         | 1 10.0                              |

1 Time limit waived.

2 Work temporarily suspended.

3 Completed.

4 Per annum.

## FINANCIAL STATEMENT, MISSISSIPPI RIVER COMMISSION, FIRST AND SECOND DISTRICTS.

*Appropriation for Mississippi River.*

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                   |              |
|---------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                  | \$100,000.00 |
| June 30, 1918, amount expended during fiscal year | 79,957.41    |

|                                                       |           |
|-------------------------------------------------------|-----------|
| July 1, 1918, balance unexpended                      | 20,042.59 |
| July 1, 1918, amount covered by uncompleted contracts | 20,042.59 |

## LOWER ST. FRANCIS LEVEE DISTRICT.

|                                                                                     |                         |
|-------------------------------------------------------------------------------------|-------------------------|
| July 1, 1917, balance unexpended                                                    | <sup>1</sup> 234,915.62 |
| July 11, 1917, amount received from sale of United States property (contact prints) | .70                     |
| Nov. 12, 1917, amount received by transfer from "Bullerton Bar, Ark."               | 40,000.00               |
|                                                                                     | 274,916.32              |
| June 30, 1918, amount expended during fiscal year                                   | 274,916.32              |

## WHITE RIVER LEVEE DISTRICT.

|                                                   |            |
|---------------------------------------------------|------------|
| July 1, 1917, balance unexpended                  | 100,000.00 |
| June 30, 1918, amount expended during fiscal year | 100,000.00 |

## REELFOOT LEVEE DISTRICT.

|                                                   |                        |
|---------------------------------------------------|------------------------|
| July 1, 1917, balance unexpended                  | <sup>2</sup> 32,018.34 |
| June 30, 1918, amount expended during fiscal year | 32,018.34              |

## GAYOSO BEND, MO.

|                                                   |                        |
|---------------------------------------------------|------------------------|
| July 1, 1917, balance unexpended                  | <sup>3</sup> 93,491.44 |
| June 30, 1918, amount expended during fiscal year | 93,491.44              |

## OSCEOLA, ARK.

|                                                              |           |
|--------------------------------------------------------------|-----------|
| Feb. 11, 1918, amount received by transfer from Helena, Ark. | 25,000.00 |
| July 1, 1918, balance unexpended and available               | 25,000.00 |

## BARFIELD, ARK.

|                                                   |                        |
|---------------------------------------------------|------------------------|
| July 1, 1917, balance unexpended                  | <sup>4</sup> 50,270.97 |
| June 30, 1918, amount expended during fiscal year | 50,270.97              |

## BULLERTON BAR, ARK.

|                                                   |             |
|---------------------------------------------------|-------------|
| July 1, 1917, balance unexpended                  | 84,757.32   |
| Less amounts transferred, as follows:             |             |
| Nov. 12, 1917, to Norfolk, Miss.                  | \$40,000.00 |
| Nov. 12 1917, to lower St. Francis levee district | 40,000.00   |
|                                                   | 80,000.00   |
|                                                   | 4,757.32    |
| June 30, 1918, amount expended during fiscal year | 4,757.32    |

<sup>1</sup> Balance reported as unexpended at end of fiscal year 1917, viz, \$234,632.52, increased \$83.10 by reimbursement received from appropriation "Pay, etc., of the Army, 1917," covering part pay of Engineer officer, paid in June, 1917, chargeable to appropriation made above.

<sup>2</sup> Balance reported as unexpended at end of fiscal year 1917, viz, \$31,970.34, increased \$8 account refundment resulting from cancellation of check for \$48 issued previous fiscal year 1918.

<sup>3</sup> Amount reported as unexpended at end of fiscal year 1917, viz, \$93,221.44, increased \$70 account reimbursement from appropriation for "Removing obstructions in Mississippi and Atchafalaya Rivers, 1917," covering value of coal paid for and transferred to St. Louis, Mo., Engineer district in fiscal year 1917.

<sup>4</sup> Amount formerly reported as unexpended at end of fiscal year 1917, viz, \$50,269.97, increased \$1 on account of refundment of overpayment on voucher in fiscal year 1917.

## MEMPHIS HARBOR.

|                                                        |             |
|--------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                  | \$4, 892. 2 |
| June 30, 1918, amount expended during fiscal year----- | 4, 892. 2   |

## NORFOLK, MISS.

|                                                                             |             |
|-----------------------------------------------------------------------------|-------------|
| Nov. 12, 1917, amount received by transfer from Bullerton, Bar,<br>Ark----- | 40, 000. 0  |
| June 30, 1918, amount expended during fiscal year-----                      | 18, 792. 5  |
| July 1, 1918, balance unexpended-----                                       | 21, 207. 47 |
| July 1, 1918, outstanding liabilities-----                                  | 13, 500. 00 |
| July 1, 1918, balance available-----                                        | 7, 707. 47  |

## PORTER LAKE, ARK.

|                                                        |             |
|--------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                  | 70, 546. 34 |
| June 30, 1918, amount expended during fiscal year----- | 70, 546. 34 |

## HELENA, ARK.

|                                                              |             |
|--------------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                        | 30, 170. 42 |
| Feb. 11, 1918, less amount transferred to Osceola, Ark.----- | 25, 000. 00 |
|                                                              | 5, 170. 42  |
| June 30, 1918, amount expended during fiscal year-----       | 649. 77     |
| July 1, 1918, balance unexpended and available-----          | 4, 520. 65  |

## OLD TOWN BEND, ARK.

|                                                        |             |
|--------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                  | 26, 822. 32 |
| June 30, 1918, amount expended during fiscal year----- | 26, 822. 32 |

## GENERAL REPAIRS AND STONE.

|                                                        |             |
|--------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                  | 45, 971. 50 |
| June 30, 1918, amount expended during fiscal year----- | 45, 971. 50 |

## PLANT.

|                                                                              |             |
|------------------------------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended-----                                        | 26, 344. 19 |
| Mar. 11, 1918, amount received from sale of United States prop-<br>erty----- | 300. 00     |
| June 14, 1918, amount received from rent of plant-----                       | 1, 144. 66  |
|                                                                              | 27, 788. 85 |
| June 30, 1918, amount expended during fiscal year-----                       | 26, 644. 19 |
| July 1, 1918, balance unexpended and available-----                          | 1, 144. 66  |

## NEW PLANT.

|                                                                 |               |
|-----------------------------------------------------------------|---------------|
| July 1, 1917, balance unexpended-----                           | 181, 791. 91  |
| June 30, 1918, amount expended during fiscal year-----          | 133, 954. 39  |
| July 1, 1918, balance unexpended-----                           | 47, 837. 52   |
| July 1, 1918, outstanding liabilities-----                      | \$45, 000. 00 |
| July 1, 1918, amount covered by uncompleted con-<br>tracts----- | 2, 837. 52    |
|                                                                 | 47, 837. 52   |

*appropriation for maintenance and improvement of existing river and harbor works, act of Oct. 2, 1914.*

## UPPER ST. FRANCIS LEVEE DISTRICT.

July 8, 1918, amounts received by transfer from allotments under office, secretary, Mississippi River Commissioner, as follows:

|                                   |            |
|-----------------------------------|------------|
| Mississippi River Commission      | \$8. 82    |
| Surveys, gauges, and observations | 63. 84     |
| Dredges and dredging              | 1, 564. 62 |

1, 637. 28

July 1, 1918, balance unexpended and available 1, 637. 28

## WATSON POINT DIKE AT SLOUGH LANDING NECK.

|                                                   |         |
|---------------------------------------------------|---------|
| July 1, 1917, balance unexpended                  | 442. 94 |
| June 30, 1918, amount expended during fiscal year | 442. 94 |

*appropriation for maintenance and improvement of existing river and harbor works, act of Mar. 4, 1914.*

## UPPER ST. FRANCIS LEVEE DISTRICT.

July 1, 1917, balance unexpended \$24, 188. 91

July 8, 1918, received by transfers from allotments as follows:

|                                                  |             |
|--------------------------------------------------|-------------|
| Office, secretary, Mississippi River Commission— |             |
| Mississippi River Commission                     | \$239. 89   |
| Surveys, gauges, and observations                | 16, 839. 26 |
| Dredges and dredging                             | 92, 773. 32 |

Mississippi River Commission, first and second districts—

|                        |             |
|------------------------|-------------|
| Slough Landing Neck    | 8, 264. 56  |
| Delta, Miss            | 10, 194. 13 |
| Experimental revetment | 2, 798. 61  |

Mississippi River Commission, fourth district—

|                            |             |
|----------------------------|-------------|
| Surveys                    | 3, 205. 09  |
| Atchafalaya levee district | 2, 372. 08  |
| Hard Times Bend            | 5, 000. 01  |
| Plaquemine                 | 1, 614. 82  |
| General repairs and stone  | 4, 574. 18  |
| Harbor at New Orleans      | 20, 335. 09 |
| Atchafalaya and Red Rivers | 167. 15     |

168, 378. 19

192, 567. 10

June 30, 1918, amount expended during fiscal year 24, 188. 91

July 1, 1918, balance unexpended 168, 378. 19

July 1, 1918, outstanding liabilities 148, 000. 00

July 1, 1918, balance available 20, 378. 19

## LOWER ST. FRANCIS LEVEE DISTRICT.

July 1, 1917, balance unexpended 0. 96

June 30, 1918, amount expended during fiscal year . 96

Amount reported as unexpended at end of fiscal year 1917, viz, \$23,010.51, increased \$78.40 for reasons following:

|                                                                                                                                                                              |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Reimbursement received from appropriation, "Pay, &c., of the Army, 1917," covering amount paid Engineer officer (for part pay, May, 1917), chargeable to appropriation named | \$183. 06 |
| Reimbursement received from Little River drainage district, incurred for count of district named, and paid in fiscal year 1917                                               | 995. 34   |

1, 178. 40

No balance was reported as unexpended at the end of fiscal year 1917, but due to adjustment received on account of overpayment amounting to 96 cents on voucher in amounts for fiscal year 1917, it becomes necessary to report a "balance unexpended," stated above.

## WHITE RIVER LEVEE DISTRICT.

|                                                                    |              |
|--------------------------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                                   | \$23, 242. 2 |
| July 12, 1917, amount received from sale of United States property | 102. 5       |
|                                                                    | 23, 344. 7   |
| June 30, 1918, amount expended during fiscal year                  | 23, 344. 7   |

## SLOUGH LANDING NECK.

|                                                                          |           |
|--------------------------------------------------------------------------|-----------|
| July 1, 1917, balance unexpended                                         | 8, 758. 2 |
| May 8, 1918, less amount transferred to Upper St. Francis levee district | 8, 264. 5 |
|                                                                          | 493. 6    |
| June 30, 1918, amount expended during fiscal year                        | 493. 6    |

## MEMPHIS HARBOR.

|                                                   |            |
|---------------------------------------------------|------------|
| July 1, 1917, balance unexpended                  | 25, 000. 0 |
| June 30, 1918, amount expended during fiscal year | 25, 000. 0 |

## DELTA, MISS.

|                                                                          |            |
|--------------------------------------------------------------------------|------------|
| July 1, 1917, balance unexpended                                         | 10, 409. 8 |
| May 8, 1918, less amount transferred to Upper St. Francis levee district | 10, 194. 1 |
|                                                                          | 215. 7     |
| June 30, 1918, amount expended during fiscal year                        | 215. 7     |

## GENERAL REPAIRS AND STONE.

|                                                   |                     |
|---------------------------------------------------|---------------------|
| July 1, 1917, balance unexpended                  | <sup>1</sup> 15. 00 |
| June 30, 1918, amount expended during fiscal year | 15. 00              |

## EXPERIMENTAL REVETMENT.

|                                                                          |            |
|--------------------------------------------------------------------------|------------|
| July 1, 1917, balance unexpended                                         | 2, 829. 27 |
| May 8, 1918, less amount transferred to upper St. Francis levee district | 2, 798. 61 |
|                                                                          | 30. 66     |
| June 30, 1918, amount expended during fiscal year                        | 30. 66     |

## NEW PLANT.

|                                                   |             |
|---------------------------------------------------|-------------|
| July 1, 1917, balance unexpended                  | 15, 000. 00 |
| June 30, 1918, amount expended during fiscal year | 15, 000. 00 |

*Appropriation for flood-control, Mississippi River, and Sacramento River, Cal.*

## SURVEYS.

|                                                                       |              |
|-----------------------------------------------------------------------|--------------|
| Aug. 10, 1917, amount allotted from sundry civil act of June 12, 1917 | \$5, 000. 00 |
| June 30, 1918, amount expended during fiscal year                     | 5, 000. 00   |

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                                       |             |
|-----------------------------------------------------------------------|-------------|
| Aug. 10, 1917, amount allotted from sundry civil act of June 12, 1917 | 90, 000. 00 |
| July 1, 1918, balance unexpended                                      | 90, 000. 00 |
| July 1, 1918, outstanding liabilities                                 | \$500. 00   |
| July 1, 1918, amount covered by uncompleted contracts                 | 78, 000. 00 |
| July 1, 1918, balance available                                       | 11, 500. 00 |

<sup>1</sup> No balance was reported as unexpended at the end of fiscal year 1917, but due to reimbursement from appropriation act "To provide compensation for employees suffering injuries, etc." (approved Sept. 7, 1916), for amounts paid in fiscal year 1917 for account of above named appropriation, it becomes necessary to report a "balance unexpended," as stated above.

## LOWER ST. FRANCIS LEVEE DISTRICT.

|                                                                       |            |              |
|-----------------------------------------------------------------------|------------|--------------|
| Aug. 10, 1917, amount allotted from sundry civil act of June 12, 1917 |            | \$450,000.00 |
| June 30, 1918, amount expended during fiscal year                     |            | 156,365.90   |
| July 1, 1918, balance unexpended                                      |            | 293,634.10   |
| July 1, 1918, outstanding liabilities                                 | \$2,000.00 |              |
| July 1, 1918, amount covered by uncompleted contracts                 | 290,000.00 | 292,000.00   |
| July 1, 1918, balance available                                       |            | 1,634.10     |

## WHITE RIVER LEVEE DISTRICT.

|                                                                       |          |            |
|-----------------------------------------------------------------------|----------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act of June 12, 1917 |          | 110,000.00 |
| June 30, 1918, amount expended during fiscal year                     |          | 86,489.31  |
| July 1, 1918, balance unexpended                                      |          | 23,510.69  |
| July 1, 1918, outstanding liabilities                                 | \$500.00 |            |
| July 1, 1918, amount covered by uncompleted contracts                 | 7,000.00 | 7,500.00   |
| July 1, 1918, balance available                                       |          | 16,010.69  |

## REELFOOT LEVEE DISTRICT.

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917 | 10,000.00 |
| June 30, 1918, amount expended during fiscal year                   | 10,000.00 |

## GAYOSO BEND, MO.

|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917 | 80,000.00 |
| Nov. 12, 1917, less amount transferred to Osceola, Ark.             | 30,000.00 |
|                                                                     | 50,000.00 |
| June 30, 1918, amount expended during fiscal year                   | 36,522.53 |
| July 1, 1918, balance unexpended                                    | 13,477.47 |
| July 1, 1918, outstanding liabilities                               | 4,200.00  |
| July 1, 1918, balance available                                     | 9,277.47  |

## BARFIELD, ARK.

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917 | 100,000.00 |
| June 30, 1918, amount expended during fiscal year                   | 79,270.05  |
| July 1, 1918, balance unexpended                                    | 20,729.95  |
| July 1, 1918, outstanding liabilities                               | 1,000.00   |
| July 1, 1918, balance available                                     | 19,729.95  |

## STAR LANDING, MISS.

|                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917                                                     | 120,000.00 |
| Nov. 30, 1917, amount transferred to Lower Yazoo levee district (third Mississippi River Commission district allotment) | 120,000.00 |

## PORTER LAKE, ARK.

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917 | 130,000.00 |
| June 30, 1918, amount expended during fiscal year                   | 105,329.69 |
| July 1, 1918, balance unexpended                                    | 24,670.31  |
| July 1, 1918, outstanding liabilities                               | 7,000.00   |
| July 1, 1918, balance available                                     | 17,670.31  |

## OLD TOWN BEND, ARK.

|                                                                      |             |
|----------------------------------------------------------------------|-------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917_ | \$40,000.00 |
| June 30, 1918, amount expended during fiscal year-----               | 40,000.00   |

## GENERAL REPAIRS AND STONE.

|                                                                      |           |
|----------------------------------------------------------------------|-----------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917_ | 50,000.00 |
| Nov. 12, 1917, less amount transferred to Osceola, Ark.-----         | 15,000.00 |
|                                                                      | <hr/>     |
|                                                                      | 35,000.00 |
| June 30, 1918, amount expended during fiscal year-----               | 35,000.00 |

## PLANT.

|                                                                      |           |
|----------------------------------------------------------------------|-----------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917_ | 75,000.00 |
| Amount received from rent of plant, as follows:                      |           |
| April 6, 1918-----                                                   | \$505.30  |
| May 7, 1918-----                                                     | 489.30    |
| May 15, 1918-----                                                    | 146.79    |
| June 11, 1918-----                                                   | 1,485.00  |
|                                                                      | <hr/>     |
|                                                                      | 2,626.39  |
|                                                                      | <hr/>     |
|                                                                      | 77,626.39 |
| June 30, 1918, amount expended during fiscal year-----               | 76,116.19 |
|                                                                      | <hr/>     |
| July 1, 1918, balance unexpended-----                                | 1,510.25  |
| July 1, 1918, outstanding liabilities-----                           | 1,510.25  |

## NEW PLANT.

|                                                                      |            |
|----------------------------------------------------------------------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917_ | 128,000.00 |
|                                                                      | <hr/>      |
| July 1, 1918, balance unexpended-----                                | 128,000.00 |
| July 1, 1918, amount covered by uncompleted contracts-----           | 20,600.00  |
|                                                                      | <hr/>      |
| July 1, 1918, balance available-----                                 | 107,400.00 |

## MEMPHIS HARBOR.

|                                                                      |            |
|----------------------------------------------------------------------|------------|
| Aug. 10, 1917, amount allotted from sundry civil act, June 12, 1917_ | 250,000.00 |
| June 30, 1918, amount expended during fiscal year-----               | 183,973.32 |
|                                                                      | <hr/>      |
| July 1, 1918, balance unexpended-----                                | 66,026.68  |
| July 1, 1918, outstanding liabilities-----                           | 28,000.00  |
|                                                                      | <hr/>      |
| July 1, 1918, balance available-----                                 | 38,026.68  |

## OSCEOLA, ARK.

|                                                        |           |
|--------------------------------------------------------|-----------|
| Nov. 12, 1917, amounts received by transfer from—      |           |
| Gayoso Bend, Mo-----                                   | 30,000.00 |
| General repairs and stone-----                         | 15,000.00 |
|                                                        | <hr/>     |
|                                                        | 45,000.00 |
| June 30, 1918, amount expended during fiscal year----- | 31,541.01 |
|                                                        | <hr/>     |
| July 1, 1918, balance unexpended and available-----    | 13,458.99 |

*Appropriation for increase of compensation, act of June 12, 1917.*

|                                                                                   |            |
|-----------------------------------------------------------------------------------|------------|
| Amount received from act above cited for expenditure during fiscal year 1918----- | \$8,000.00 |
| June 30, 1918, amount expended during fiscal year-----                            | 7,551.58   |
|                                                                                   | <hr/>      |
| July 1, 1918, balance unexpended (available)-----                                 | 448.42     |

*Funds contributed for improvement of Mississippi River in upper St. Francis levee district.*

SPECIAL FUNDS (CONTRIBUTED) FOR EXPENDITURE BY THE ST. JOHN LEVEE AND DRAINAGE DISTRICT, NEW MADRID, MO., AND MISSISSIPPI COUNTY LEVEE DISTRICT NO. 1, CHARLESTON, MO.

|                                                       |              |
|-------------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                      | \$207,265.31 |
| June 30, 1918, amount expended during fiscal year     | 78,919.31    |
| July 1, 1918, balance unexpended                      | 128,346.00   |
| July 1, 1918, amount covered by uncompleted contracts | 128,346.00   |

*Funds contributed for improvement of Mississippi River at Norfolk, Miss.*

## SPECIAL FUND.

Amounts contributed for expenditure by the Yazoo-Mississippi Delta levee district, Clarksdale, Miss., as follows:

|                                                   |             |
|---------------------------------------------------|-------------|
| Oct. 25, 1917                                     | \$25,000.00 |
| Nov. 26, 1917                                     | 25,000.00   |
|                                                   | \$50,000.00 |
| June 30, 1918, amount expended during fiscal year | 50,000.00   |

*Special funds contributed for flood-control, Mississippi River (levee construction), under provisions of flood-control act approved Mar. 1, 1917.*

## REELFOOT LEVEE DISTRICT.

|                                                                                                    |            |
|----------------------------------------------------------------------------------------------------|------------|
| Aug. 16, 1917, amount contributed for expenditure by the Fulton County levee district, Hickman, Ky | \$5,000.00 |
| June 30, 1918, amount expended during fiscal year                                                  | 5,000.00   |

## UPPER ST. FRANCIS LEVEE DISTRICT.

|                                                                                                                    |             |
|--------------------------------------------------------------------------------------------------------------------|-------------|
| Sept. 27, 1917, amount contributed for expenditure by the Mississippi County levee district No. 1, Charleston, Mo. | \$45,000.00 |
| July 1, 1918, balance unexpended                                                                                   | 45,000.00   |
| July 1, 1918, amount covered by uncompleted contracts                                                              | 45,000.00   |

## LOWER ST. FRANCIS LEVEE DISTRICT.

|                                                                                                                     |              |
|---------------------------------------------------------------------------------------------------------------------|--------------|
| Aug. 28, 1917, amount contributed for expenditure by the St. Francis levee district, Bridge Junction, Ark           | \$225,500.00 |
| Sept. 6, 1917, amount contributed for expenditure by the St. Francis levee district of Missouri, Caruthersville, Mo | 22,000.00    |
|                                                                                                                     | 247,500.00   |
| July 1, 1918, balance unexpended                                                                                    | 247,500.00   |
| July 1, 1918, amount covered by uncompleted contracts                                                               | 247,500.00   |

## WHITE RIVER LEVEE DISTRICT.

Amounts contributed for expenditure by the Laconia levee district No. 1, Henrico, Ark., viz:

|                                                       |             |
|-------------------------------------------------------|-------------|
| Oct. 18, 1917                                         | \$54,626.66 |
| Nov. 22, 1917                                         | 373.34      |
|                                                       | \$55,000.00 |
| June 30, 1918, amount expended during fiscal year     | 30,200.36   |
| July 1, 1918, balance unexpended                      | 24,799.64   |
| July 1, 1918, amount covered by uncompleted contracts | 24,799.64   |

## APPENDIX 3.

## IMPROVING MISSISSIPPI RIVER, THIRD DISTRICT.

This district extends from White River, Ark., to Warrenton, Miss., a distance of 214 miles by river.

District headquarters: Vicksburg, Miss.

District engineer: Maj. J. R. Slattery, Corps of Engineers, United States Army, to August 27, 1917; Lieut. Col. G. P. Howell, Corps of Engineers, United States Army, August 27 to September 24, 1917; A. M. Todd, assistant engineer in charge since September 25, 1917.

## WORKS.

## I. Revetments:

- (a) Lake Bolivar Front, Miss.
- (b) Ashbrook Neck, Miss.
- (c) Panther Forest, Ark.
- (d) Leland Neck, Ark.
- (e) Greenville, Miss.
- (f) Vacluse, Ark.
- (g) Longwood, Miss.
- (h) Grand Lake, Ark.
- (i) Princeton, Miss.
- (j) Lake Providence, La.
- (k) Fitlers Bend, Miss.
- (l) Cottonwood, Miss.

## I. Revetments—Continued.

- (m) Albemarle Bend, Miss.
- (n) Delta Point, La.
- (o) Vicksburg Harbor, Miss.
- (p) Reid-Bedford Bend, La.
- (q) Red Fork, Ark.

## II. Levees:

- (a) Upper Tensas levee district.
- (b) Lower Yazoo levee district.

## III. Surveys:

- (a) Revetment.
- (b) Reach and bank line.

## IV. Plant.

## I. REVETMENTS.

(a) *Lake Bolivar Front, Miss.*

*Location and description.*—Four hundred and seventeen miles below Cairo, left bank. Bank revetment.

*Original condition.*—Caving appears to have become active at this point about 1887, and by the latter part of 1888 it became evident that, unless the bank was revetted, the levee across the head of Lake Bolivar would be destroyed. The destruction of this levee would have necessitated building a long and expensive loop back of the lake.

*Previous projects.*—None.

*Existing project.*—The present project was adopted by the river and harbor act approved August 11, 1888, and provides for a revetment to correct, permanently locate, and deepen the channel of the river and to protect its bank against caving, and thus save a levee, situated between the head of Lake Bolivar and the river, the destruction of which would have resulted in the abandonment of a large area of valuable land, and would have necessitated the construction of a long and expensive loop back of Lake Bolivar.

*Operations and results during the present year.*—None.

*Condition at end of year.*—Effective length of the revetment is 8,640 feet; all in good condition except at some points along the upper bank where willow mats have been used above low water. These places should be repaved with stone. Caving below the revetment continues active, and an extension downstream of about 3,000 feet will be required to protect the controlling levee line.

The cost of this work to end of present year for new work amounts to \$296,222 and for maintenance \$184,688.18, a total of \$480,910.18.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The bank along this front has been held, the levee has been saved, a large area of land has been protected, and the channel has been permanently located.

*Proposed operations.*—It is proposed to make the necessary repairs to maintain the work in good condition, and to extend downstream 3,000 feet.

*Recommended modifications of project.*—None.

*Reference to published articles not previously reported.*—None.

## (b) Ashbrook Neck, Miss.

*Location and description.*—Four hundred and forty-six miles below Cairo, left bank. Bank revetment and spur dike.

*Original condition.*—In 1870 the width of this point at the narrowest place was approximately 4,300 feet. By 1890, caving along the upper side of the point had reduced the width of the neck to 2,300 feet. As there was no reason to expect the caving to stop from natural causes, a cut-off across this neck seemed imminent, unless steps were taken to prevent it. A cut-off would have upset the regimen of the river in this locality, and would have resulted in the loss of many miles of levee, the destruction of a large area of cultivated land, and bad channel conditions before the river could again adjust its slope.

*Previous projects.*—None.

*Existing project.*—While the original project, adopted in 1890, provided for the prevention of a cut-off by the construction of a series of spur dikes on the upper side of the neck to check erosion, and the retardation of the flow across the neck by slashings, it was modified during construction to provide continuous revetment in lieu of spur dikes, and a levee about 7,000 feet long in lieu of the slashings. The project was further modified in 1915, requiring the construction of an earthen dike, or levee to commission grade, about 26,000 feet long, extending from the main levee line to or near the high ground at the west end of Ashbrook Point.

*Operations and results during the present year—Revetment.*—Repairs were made to the existing revetment, requiring 637 squares of subaqueous willow mats and 805 squares of upper bank paved with stone at a cost of \$17,402.38, charged to maintenance.

The revetment was extended downstream 1,100 feet, work on which was commenced September 17 and completed November 30. The type of work used was concrete upper bank paving and the reinforced type of concrete subaqueous mats, of which there were 3,076 squares sunk in place, 1,582 squares of upper bank paved with concrete, and 324 squares of brush and stone revetment placed. The total cost of new work amounted to \$49,867.05. Details of costs and expenditures are given in the tables following; and location of work is shown in accompanying plate No. 3.

## ASHBROOK NECK REVETMENT (446 L.), THIRD DISTRICT.

*Reinforced concrete mattresses, total area 9,367 squares.<sup>1</sup>*

## BUILDING CONCRETE MATS.

|                                                     | Quantity used.  |             | Per square. |         |
|-----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                     | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilizing and demobilization <sup>2</sup> .....    |                 | \$2,540.82  |             | \$0.271 |
| reinforcing wire fabric <sup>3</sup> .....squares.. | 9,368           | 10,679.52   | 1.00        | 1.140   |
| raft paper <sup>4</sup> .....pounds..               | 9,637           | 802.30      | 1.02        | .086    |
| rope, manila <sup>5</sup> .....do.....              | 3,856           | 1,156.74    | .41         | .123    |
| ment <sup>6</sup> .....sacks..                      | 27,881          | 13,661.69   | 3.00        | 1.459   |
| nd and gravel <sup>7</sup> .....cubic yards..       | 9,496           | 7,216.96    | 1.01        | .769    |
| al <sup>8</sup> .....tons..                         | 160             | 792.00      | .02         | .085    |
| 14.....                                             |                 | 50.00       |             | .005    |
| miscellaneous expenses <sup>9</sup> .....           |                 | 750.00      |             | .080    |

<sup>1</sup> Mattresses manufactured at Greenville, Miss., output used at following localities:

Squares.

|                        |       |
|------------------------|-------|
| Ashbrook Neck .....    | 3,076 |
| Winneton .....         | 3,129 |
| Wicksburg Harbor ..... | 3,162 |

<sup>2</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters at a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>3</sup> The reported cost of the material is the cost delivered on the job.

<sup>4</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>5</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

*Reinforced concrete mattresses, total area 9,367 squares—Continued.*

## BUILDING CONCRETE MATS—Continued.

|                                               | Quantity used.  |             | Per square. |        |
|-----------------------------------------------|-----------------|-------------|-------------|--------|
|                                               | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Subsistence <sup>1</sup> .....                |                 | \$7,234.52  |             | \$0.77 |
| Steamboat expenses <sup>2</sup> .....         |                 | 6,376.72    |             | .68    |
| Labor <sup>3</sup> .....                      |                 | 6,177.66    |             | .65    |
| Supervision <sup>4</sup> .....                |                 | 2,413.95    |             | .25    |
| Total.....                                    |                 | 59,952.88   |             |        |
| Used at Ashbrook Neck 3,076 squares—New work: |                 |             |             |        |
| Reinforced concrete mats.....squares..        | 3,076           | 19,686.40   |             | 6.40   |
| Willow connecting mats.....do.....            | 324             | 3,232.10    |             | 9.97   |
| Total.....                                    |                 | 22,918.50   |             |        |

## SINKING CONCRETE MATS.

|                                                    |        |            |      |        |
|----------------------------------------------------|--------|------------|------|--------|
| Mobilization and demobilization <sup>5</sup> ..... |        | \$1,062.02 |      | \$0.34 |
| 3-inch strand <sup>6</sup> .....pounds..           | 39,551 | 2,867.45   | 13.0 | .93    |
| 3-inch clips <sup>6</sup> .....do.....             | 13,703 | 931.80     | 4.6  | .30    |
| Rope, manila <sup>6</sup> .....do.....             | 3,856  | 1,156.74   | 1.22 | .37    |
| Coal <sup>7</sup> .....tons..                      | 78.6   | 388.69     | .026 | .12    |
| Oil <sup>7</sup> .....                             |        | 50.00      |      | .01    |
| Miscellaneous expenses <sup>8</sup> .....          |        | 629.71     |      | .20    |
| Subsistence <sup>1</sup> .....                     |        | 2,308.80   |      | .75    |
| Steamboat expenses <sup>2</sup> .....              |        | 800.00     |      | .26    |
| Labor <sup>3</sup> .....                           |        | 2,374.21   |      | .77    |
| Supervision <sup>4</sup> .....                     |        | 721.63     |      | .23    |
| Total.....                                         |        | 13,291.05  |      |        |

*Grading (2,500 squares).*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>7</sup> .....tons..             | 132.8           | \$657.86    | 0.053       | \$0.263 |
| Oil <sup>7</sup> .....                    |                 | 44.31       |             | .018    |
| Miscellaneous expenses <sup>8</sup> ..... |                 | 93.71       |             | .037    |
| Subsistence <sup>1</sup> .....            |                 | 907.34      |             | .363    |
| Labor <sup>3</sup> .....                  |                 | 1,723.75    |             | .689    |
| Total.....                                |                 | 3,426.97    |             |         |

<sup>1</sup> This item is the cost of the served ration.<sup>2</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.<sup>3</sup> Includes wages of all employed on the work except those specified in 4.<sup>4</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.<sup>5</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.<sup>6</sup> The reported cost of the material is the cost delivered on the job.<sup>7</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.<sup>8</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

*Paving (concrete, 1,582 squares).*

|                                                    | Quantity used.  |             | Per square. |        |
|----------------------------------------------------|-----------------|-------------|-------------|--------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Cement <sup>1</sup> .....sacks.....                | 6,940           | \$3,400.60  | 4.39        | \$2.15 |
| Sand and gravel <sup>1</sup> .....cubic yards..... | 2,095           | 1,592.20    | 1.32        | 1.007  |
| Coal <sup>2</sup> .....tons.....                   | 56              | 277.20      | .035        | .175   |
| Subsistence <sup>3</sup> .....                     |                 | 942.50      |             | .596   |
| Towboat expenses <sup>4</sup> .....                |                 | 200.00      |             | .126   |
| Labor <sup>5</sup> .....                           |                 | 2,007.78    |             | 1.269  |
| Supervision <sup>6</sup> .....                     |                 | 357.81      |             | .226   |
| Total.....                                         |                 | 8,778.09    |             |        |

*Summary of costs (linear feet revetted, 1,100).*

|                                          | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                          | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....                    | \$11.77          | \$36,209.55 | \$7.72           | \$12,205.06 | \$48,414.61  | \$44.01                     |
| Office expenses.....                     |                  |             |                  |             | 1,452.44     | 8.79                        |
| Surveys <sup>7</sup> .....               |                  |             |                  |             | 196.00       |                             |
| Use of plant <sup>8</sup> .....          |                  |             |                  |             | 1,327.26     |                             |
| Repair of plant.....                     |                  |             |                  |             | 2,752.32     |                             |
| Depreciation of plant <sup>9</sup> ..... |                  |             |                  |             | 3,944.14     |                             |
| Total.....                               |                  |             |                  |             | 58,086.77    | 52.80                       |

<sup>1</sup> The reported cost of the material is the cost delivered on the job.

<sup>2</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>3</sup> This item is the cost of the served ration.

<sup>4</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses boats in general towing service, and inspection and survey boats.

<sup>5</sup> Includes wages of all employed on the work except those specified in 6.

<sup>6</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

<sup>7</sup> This item includes actual cost of survey work done on this revetment.

<sup>8</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account inclement weather conditions or unfavorable river stages.

<sup>9</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 10 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

## ASHBROOK NECK REVETMENT (446 L.), THIRD DISTRICT—REPAIR WORK.

*Willow mattresses, total area 637 squares (connecting, 100 per cent).*

## BUILDING MATS.

|                                                          | Quantity used.  |             | Per square. |         |
|----------------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                          | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> .....       |                 | \$550.00    |             | \$0.863 |
| $\frac{3}{8}$ -inch strand <sup>2</sup> .....pounds..... | 5,742           | 413.42      | 9.07        | .649    |
| $\frac{1}{2}$ -inch strand <sup>2</sup> .....do.....     | 8,676           | 589.97      | 13.62       | .920    |
| $\frac{3}{4}$ -inch strand <sup>2</sup> .....do.....     | 1,120           | 63.84       | 1.76        | .100    |
| Staples <sup>2</sup> .....number.....                    | 25              | .92         | .04         | .002    |
| Spikes <sup>2</sup> .....do.....                         | 200             | 6.20        | .31         | .010    |
| Brush and poles <sup>2</sup> .....cords.....             | 1,474           | 2,269.96    | 2.31        | 3.563   |
| Coal <sup>3</sup> .....tons.....                         | 24              | 118.80      | .04         | .186    |
| Miscellaneous expenses <sup>4</sup> .....                |                 | 300.00      |             | .471    |
| Steamboat expenses <sup>5</sup> .....                    |                 | 250.00      |             | .392    |
| Labor <sup>6</sup> .....                                 |                 | 1,029.48    |             | 1.616   |
| Supervision <sup>7</sup> .....                           |                 | 510.00      |             | .801    |
| Total.....                                               |                 | 6,103.09    |             |         |

## BALLASTING AND SINKING MATS.

|                                                    |     |          |      |         |
|----------------------------------------------------|-----|----------|------|---------|
| Mobilization and demobilization <sup>1</sup> ..... |     | \$350.00 |      | \$0.549 |
| Stone <sup>2</sup> .....tons.....                  | 510 | 1,174.00 | 0.80 | 1.843   |
| Coal <sup>3</sup> .....do.....                     | 16  | 79.20    | .02  | .124    |
| Miscellaneous expenses <sup>4</sup> .....          |     | 100.00   |      | .157    |
| Steamboat expenses <sup>5</sup> .....              |     | 450.00   |      | .707    |
| Labor <sup>6</sup> .....                           |     | 178.12   |      | .280    |
| Supervision <sup>7</sup> .....                     |     | 89.50    |      | .141    |
| Total.....                                         |     | 2,420.82 |      |         |

*Grading (1,600 squares).*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>3</sup> .....tons.....          | 43.2            | \$213.84    | 0.05        | \$0.134 |
| Oil <sup>3</sup> .....                    |                 | 38.62       |             | .024    |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 130.52      |             | .082    |
| Subsistence <sup>8</sup> .....            |                 | 375.33      |             | .235    |
| Labor <sup>6</sup> .....                  |                 | 905.14      |             | .566    |
| Total.....                                |                 | 1,663.45    |             |         |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>6</sup> Includes wages of all employed on the work except those specified in 7.

<sup>7</sup> In-cludes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

<sup>8</sup> This item is the cost of the served ration.

*Stone (paving, 805 squares).*

|                                         | Quantity used.  |             | Per square. |         |
|-----------------------------------------|-----------------|-------------|-------------|---------|
|                                         | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Stone <sup>1</sup> ..... tons.....      | 1,623           | \$4,158.50  | 2.02        | \$5.166 |
| Oil <sup>2</sup> ..... do.....          | 31.4            | 155.43      | .04         | .193    |
| Scellaneous expenses <sup>3</sup> ..... |                 | 100.00      |             | .124    |
| Assistance <sup>4</sup> .....           |                 | 596.70      |             | .741    |
| Samboat expenses <sup>5</sup> .....     |                 | 300.00      |             | .372    |
| Labor <sup>6</sup> .....                |                 | 1,254.16    |             | 1.558   |
| Supervision <sup>7</sup> .....          |                 | 159.87      |             | .198    |
| Total.....                              |                 | 6,724.66    |             |         |

*Summary of costs—Repair work.*

|                               | Subaqueous work. |            | Upper bank work. |            | Grand total. |
|-------------------------------|------------------|------------|------------------|------------|--------------|
|                               | Per square.      | Total.     | Per square.      | Total.     |              |
| Field cost <sup>8</sup> ..... | \$11.81          | \$8,523.91 | \$10.41          | \$8,388.11 | \$16,912.02  |
| Other expenses.....           |                  |            |                  |            | 492.36       |
| Total.....                    |                  |            |                  |            | 17,404.38    |

The reported cost of material is the cost delivered on the job.

These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

This includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats, quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be added to plant.

This item is the cost of the served ration.

This item includes all the expenses of operating the tenders, and no others, and excludes all expenses on boats in general towing service, and inspection and survey boats.

Includes wages of all employed on the work except those specified in 7.

Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

In adding total field cost omit totals under headings "Per square."

**Dike.**—The construction of an earthwork levee dike was resumed on July by the two Bucyrus drag-line levee machines B-4 and B-5. Very good progress was made during the working season, although much time was lost on account of serious labor shortage, both by the clearing contractor and by the labor force. Severe freezing winter weather during December and January delayed the work, the delays preventing the closing of the gap between the existing levee dike and the new dike. Early in February an approaching high water made it necessary to suspend work and secure the end of the new part of the dike. Work was continued with one machine enlarging the existing levee dike extending from the controlling levee a length of 1,900 feet and to which the new portion of the dike is to be joined.

During the year 537,276 cubic yards of earthwork was placed at a cost of \$465.61, which completes a total of 24,800 feet of dike to date, containing a total of 959,946 cubic yards, there remaining to complete 1,500 feet containing approximately 115,000 cubic yards.

The damage from last season's high water at the extreme lower end of the part of the dike was repaired and a secondary dike was built across deep ditches in the borrow pits and end of this dike paved with concrete. A total of 1,971 cubic yards of earthwork was placed, and 290 squares of concrete pavement. This work cost \$35,768.09, which was charged to maintenance.

**Conditions at end of year.**—The present effective length of the revetment is 100 feet, and the levee dike, 26,700 feet; all in good condition. Caving conditions below the revetment and a further extension downstream of about 3,000 feet will be needed to effectively protect the dike.

The expenditures on this work to end of present year for new work amounts to \$63,649.13, and for maintenance, \$366,895.30, a total of \$1,030,544.43.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The work accomplished has prevented a cut-off and permanently fixed the channel.

*Proposed operations.*—It is proposed to extend the revetment about 2,000 feet downstream, and to complete the spur levee, 26,300 feet in length, authorized May 22, 1915.

*Recommended modifications of project.*—None.

*Reference to published articles not previously reported.*—None.

(c) *Panther Forest, Ark.*

*Location and description.*—Four hundred and fifty-two miles below Cairo, right bank. Bank revetment.

*Original condition.*—Caving has been in progress since the earliest surveys—1879 and 1880. In 1908 the controlling levee line was threatened at a point where relocation would have been expensive on account of having to cross an old river bed.

*Previous projects.*—None.

*Existing projects.*—To protect the large and important levee line at this locality and to permanently locate the channel.

*Operations and results during the present year.*—All the uncompleted bank work along the previous year's work was completed. Reinforcing and connecting mats were sunk all along the lower half of the work where the upper bank paving had sloughed. All the sloughs were graded but not paved; 1,812 squares of willow subaqueous mats and 1,895 squares of concrete upper bank paving were placed. The cost of this work amounted to \$38,409.35, of which \$27,131.44 is chargeable to maintenance and \$11,277.91 to new work. Details of costs and expenditures are given in the tables following, and location of work is shown on accompanying plate No. 4.

PANTHER FOREST REVETMENT (452 R.), THIRD DISTRICT.

*Mattresses, total area 1,812 squares.*

BUILDING WILLOW MATS.

|                                                       | Quantity used.  |                  | Per square. |        |
|-------------------------------------------------------|-----------------|------------------|-------------|--------|
|                                                       | Total quantity. | Total cost.      | Quantity.   | Cost.  |
| Mobilization and demobilization <sup>1</sup> .....    |                 | \$1,248.48       |             | \$0.58 |
| $\frac{1}{2}$ -inch strand <sup>2</sup> .....pounds.. | 6,950           | 396.15           | 3.84        | .21    |
| $\frac{3}{4}$ -inch strand <sup>2</sup> .....do....   | 19,200          | 1,382.40         | 10.60       | .76    |
| $\frac{1}{2}$ -inch strand <sup>2</sup> .....do....   | 22,825          | 1,584.10         | 12.60       | .87    |
| $\frac{3}{4}$ -inch strand <sup>2</sup> .....do....   | 250             | 18.12            | 1.14        | .01    |
| Staples <sup>2</sup> .....number..                    | 320             | 11.84            | .17         | .00    |
| Spikes <sup>2</sup> .....do....                       | 100             | 3.10             | .05         | .00    |
| Brush and poles <sup>2</sup> .....cords.              | 2,912           | 4,484.48         | 1.75        | 2.47   |
| Coal <sup>3</sup> .....tons..                         | 36.8            | 182.16           | .02         | .10    |
| Miscellaneous expenses <sup>4</sup> .....             |                 | 571.72           |             | .31    |
| Subsistence <sup>5</sup> .....                        |                 | 885.29           |             | .48    |
| Steamboat expenses <sup>6</sup> .....                 |                 | 450.00           |             | .24    |
| Labor <sup>7</sup> .....                              |                 | 1,562.61         |             | .86    |
| Supervision <sup>8</sup> .....                        |                 | 1,020.00         |             | .56    |
| <b>Total</b> .....                                    |                 | <b>13,800.45</b> |             |        |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters, or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats, and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## PANTHER FOREST REVETMENT (452 R.), THIRD DISTRICT—continued.

## Mattresses, total area 1,812 squares—Continued.

## BALLASTING AND SINKING MATS.

|                                                    |        | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|--------|-----------------|-------------|-------------|---------|
|                                                    |        | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>1</sup> ..... |        |                 | \$624.24    |             | \$0.344 |
| one <sup>2</sup> .....                             | tons.. | 2,085           | 5,212.50    | 1.14        | 2.877   |
| oil <sup>3</sup> .....                             | do..   | 24.6            | 121.77      | .013        | .067    |
| miscellaneous expenses <sup>4</sup> .....          |        |                 | 410.00      |             | .226    |
| assistance <sup>5</sup> .....                      |        |                 | 327.68      |             | .181    |
| teamboat expenses <sup>6</sup> .....               |        |                 | 300.00      |             | .166    |
| labor <sup>7</sup> .....                           |        |                 | 457.50      |             | .253    |
| supervision <sup>8</sup> .....                     |        |                 | 250.00      |             | .137    |
| Total.....                                         |        |                 | 7,703.69    |             |         |

## Grading (2,035 squares).

|                                           |        | Quantity used.  |             | Per square. |         |
|-------------------------------------------|--------|-----------------|-------------|-------------|---------|
|                                           |        | Total quantity. | Total cost. | Quantity.   | Cost.   |
| oil <sup>3</sup> .....                    | tons.. | 118.7           | \$587.56    | 0.058       | \$0.288 |
| oil <sup>3</sup> .....                    |        |                 | 29.97       |             | .015    |
| miscellaneous expenses <sup>4</sup> ..... |        |                 | 240.00      |             | .216    |
| assistance <sup>5</sup> .....             |        |                 | 1,523.33    |             | .748    |
| labor <sup>7</sup> .....                  |        |                 | 2,127.72    |             | 1.045   |
| Total.....                                |        |                 | 4,508.58    |             |         |

## Paving (concrete, 1,895 squares).

|                                                    |               | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|---------------|-----------------|-------------|-------------|---------|
|                                                    |               | Total quantity. | Total cost. | Quantity.   | Cost.   |
| mobilization and demobilization <sup>1</sup> ..... |               |                 | \$624.24    |             | \$0.329 |
| one <sup>2</sup> .....                             | tons..        | 223             | 557.50      | 0.118       | .294    |
| ment <sup>2</sup> .....                            | sacks..       | 7,754           | 3,799.46    | 4.09        | 2.003   |
| and gravel <sup>2</sup> .....                      | cubic yards.. | 2,340           | 1,778.40    | 1.23        | .939    |
| oil <sup>3</sup> .....                             | tons..        | 54              | 267.30      | .003        | .141    |
| miscellaneous expenses <sup>4</sup> .....          |               |                 | 250.00      |             | .137    |
| assistance <sup>5</sup> .....                      |               |                 | 1,409.33    |             | .744    |
| labor <sup>7</sup> .....                           |               |                 | 1,847.47    |             | .975    |
| supervision <sup>8</sup> .....                     |               |                 | 744.21      |             | .393    |
| Total.....                                         |               |                 | 11,277.91   |             |         |

Includes in each case the cost of assembling and moving plant and material, either from winter quarter or previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

The reported cost of the material is the cost delivered on the job.

These items include only the coal and oil used on the graders, upper bank-paving machinery, and dred pumps. The coal used on tenders and towboats will not be included under this heading.

This includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats at winter quarters, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

This item is the cost of the served ration.

This item includes all the expenses of operating the tenders, and no others, and excludes all expenses on boats in general towing service, and inspection and survey boats.

Includes wages of all employed on the work except those specified in 8.

Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## PANTHER FOREST REVETMENT (452 R.), THIRD DISTRICT—continued.

*Summary of costs—Repair work.*

|                                          | Subaqueous work. |              | Upper bank work. |              | Grand total. |
|------------------------------------------|------------------|--------------|------------------|--------------|--------------|
|                                          | Per square.      | Total.       | Per square.      | Total.       |              |
| Total field cost.....                    | \$11. 86         | \$21,504. 14 | \$8. 33          | \$15,786. 49 | \$37,290.    |
| Office expenses.....                     |                  |              |                  |              | 1,118.       |
| Surveys <sup>1</sup> .....               |                  |              |                  |              | 112.         |
| Care of plant <sup>2</sup> .....         |                  |              |                  |              | 798.         |
| Repair of plant.....                     |                  |              |                  |              | 1,653.       |
| Depreciation of plant <sup>3</sup> ..... |                  |              |                  |              | 2,369.       |
| Total.....                               |                  |              |                  |              | 43,341.      |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.

<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The effective length of the revetment is 7,500 feet all in good condition except one break in the upper bank between ranges 16 and 20, which occurred during the February, 1918, rise. Active caving continues above and below the revetment, and an extension upstream of about 1,000 feet will be required the coming year in order to protect the controlling levee line.

The expenditures on this work to end of present year for new work amount to \$281,242.03, and for maintenance \$236,849.57, a total of \$518,091.60.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The bank has been held, the levee saved, and the channel permanently located.

*Proposed operations.*—It is proposed to make necessary repairs to maintain work in good condition, and to extend revetment upstream 1,000 feet.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

## (d) Leland Neck, Ark.

*Location and description.*—Four hundred and seventy-one miles below Cair right bank. Bank revetment.

*Original condition.*—In 1880 the width of the neck at the narrowest point was approximately 5,500 feet. The banks continued to cave at this point until the width of the neck was reduced to 2,600 feet, and it was necessary torevet the bank to prevent a cut-off. A cut-off at this point would have had a disastrous effect on the regimen of the river similar to that described at Ashbrook Neck.

*Previous projects.*—None.

*Existing project.*—To prevent a cut-off and fix the channel by bank revetment.

*Operations and results during the present year.*—None.

*Condition at end of year.*—Effective length 5,000 feet, all in good condition. Caving continued above and below the revetment at a moderate rate. The expenditures on this work to end of present year for new work amount to \$187,956, and for maintenance \$8,385.66, a total of \$196,341.66.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The revetment placed at this point has protected the bank, prevented a cut-off, and permanently located the channel.

*Proposed operations.*—It is proposed to make necessary repairs to maintain the work in good condition.

*Recommended modification of project.*—None.

*References to published articles not previously reported.*—None.

(c) *Greenville Harbor, Miss.*

*Location and description.*—Four hundred and seventy-three miles below Cairo, left bank. Bank revetment.

*Original condition.*—Caving has been in progress since the earliest surveys—1879–80. During the 12 years from 1882 to 1894 the bank in the Greenville Bend receded about 4,000 feet. A large portion of the town of Greenville had caved into the river and the complete demolition of the remainder of the town and harbor was threatened. New levee loops had been repeatedly constructed to cover the front line being breached by caving, and been in turn destroyed.

*Previous projects.*—The original project, adopted in 1887, provided for protection of the bank by means of submerged spur dikes.

*Existing project.*—Adopted in 1891, provides for protection of the bank with continuous revetment.

*Operations and results during the present year.*—A standard fascine channel mat 1,000 by 255 feet was sunk together with the necessary connecting mats, which extended the effective revetment downstream 1,070 feet. Between ranges 80 and 87, for a length of 700 feet at the upper end of the new extension, the slope was graded with teams to 7 horizontal to 1 vertical, extending from top of controlling levee line to low water, and the material excavated was used to construct 1,330 linear feet of levee to commission grade and section. The levee work was paid for from allotment of flood-control funds made to the lower Yazoo levee district.

The slope was paved with concrete 7 inches thick constructed under standard road specifications. The surface was grooved in imitation of cobblestone. The top of the levee and two road crossings on the land side of the levee were also paved. This work was done in cooperation with the city of Greenville as noted in paragraph on "Local cooperation." The work done aggregated 3,418 squares of subaqueous willow mats placed, 490 squares of brush and stone revetment, 46 squares of upper bank paved with ordinary concrete 4 inches thick, and 904 squares paved with extra concrete 7 inches thick for city wharf, requiring 565 cubic yards of concrete at a unit cost of \$22.78 per square. The total expenditures were as follows:

|                                     |             |
|-------------------------------------|-------------|
| For standard revetment and pavement | \$49,176.87 |
| For city wharf pavement             | 43,380.13   |
| Total                               | \$92,557.00 |

11 of which is charged to new work. Details of costs and expenditures are given in the tables following, and location of work is shown on accompanying plate No. 5.

## GREENVILLE REVETMENT (478 L.), THIRD DISTRICT—NEW WORK.

*Mattresses, total area 3,908 squares (channel, 75 per cent; connecting, 25 per cent).*

## BUILDING WILLOW MATS.

|                                                       | Quantity used.  |             | Per square. |       |
|-------------------------------------------------------|-----------------|-------------|-------------|-------|
|                                                       | Total quantity. | Total cost. | Quantity.   | Cost. |
| Mobilization and demobilization <sup>1</sup> .....    |                 | \$1,175.37  |             | 0.30  |
| $\frac{3}{8}$ -inch strand <sup>2</sup> .....pounds.. | 36,400          | 2,620.80    | 9.31        | .67   |
| $\frac{1}{2}$ -inch strand <sup>2</sup> .....do.....  | 28,000          | 1,904.00    | 7.16        | .48   |
| $\frac{3}{4}$ -inch strand <sup>2</sup> .....do.....  | 12,200          | 595.40      | 3.12        | .15   |
| $\frac{1}{2}$ -inch strand <sup>2</sup> .....do.....  | 500             | 36.25       | .13         | .00   |
| Staples <sup>2</sup> .....number.....                 | 690             | 25.53       | .18         | .00   |
| Spikes <sup>2</sup> .....do.....                      | 400             | 12.40       | .10         | .00   |
| Brush and poles <sup>2</sup> .....cords.....          | 5,839           | 8,992.06    | 1.48        | 2.30  |
| Rope, manila <sup>2</sup> .....pounds.....            | 3,856           | 1,156.74    | .98         | .29   |
| Coal <sup>3</sup> .....tons.....                      | 21.6            | 106.92      | .005        | .02   |
| Miscellaneous expenses <sup>4</sup> .....             |                 | 534.27      |             | .13   |
| Subsistence <sup>5</sup> .....                        |                 | 1,898.67    |             | .48   |
| Steamboat expenses <sup>6</sup> .....                 |                 | 550.00      |             | .14   |
| Labor <sup>7</sup> .....                              |                 | 5,245.74    |             | 1.34  |
| Supervision <sup>8</sup> .....                        |                 | 1,700.04    |             | .43   |
| Total.....                                            |                 | 26,554.19   |             |       |

## BALLASTING AND SINKING MATS.

|                                                    |       |           |      |        |
|----------------------------------------------------|-------|-----------|------|--------|
| Mobilization and demobilization <sup>1</sup> ..... |       | \$587.68  |      | \$0.15 |
| Stone <sup>2</sup> .....tons.....                  | 2,917 | 7,292.50  | 0.75 | 1.86   |
| Rope, manila <sup>2</sup> .....pounds.....         | 3,856 | 1,156.74  | .98  | .29    |
| Coal <sup>3</sup> .....tons.....                   | 49    | 242.55    | .013 | .06    |
| Miscellaneous expenses <sup>4</sup> .....          |       | 325.00    |      | .08    |
| Subsistence <sup>5</sup> .....                     |       | 243.67    |      | .06    |
| Steamboat expenses <sup>6</sup> .....              |       | 350.00    |      | .09    |
| Labor <sup>7</sup> .....                           |       | 1,421.25  |      | .36    |
| Supervision <sup>8</sup> .....                     |       | 400.00    |      | .10    |
| Total.....                                         |       | 12,019.39 |      |        |

## Grading (1,550 squares).

|                                           | Quantity used.  |             | Per square. |        |
|-------------------------------------------|-----------------|-------------|-------------|--------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Coal <sup>3</sup> .....tons.....          | 134.5           | \$665.77    | 0.87        | \$0.42 |
| Oil <sup>3</sup> .....                    |                 | 12.08       |             | .00    |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 290.00      |             | .18    |
| Subsistence <sup>5</sup> .....            |                 | 708.67      |             | .45    |
| Labor <sup>7</sup> .....                  |                 | 2,027.53    |             | 1.30   |
| Total.....                                |                 | 3,704.05    |             |        |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## GREENVILLE REVETMENT (478 L.), THIRD DISTRICT—NEW YORK—continued.

## Paving (746 squares).

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$587.68    |             | \$0.787 |
| Cement <sup>2</sup> .....sacks..                   | 2,622           | 1,284.78    | 3.50        | 1.722   |
| Sand and gravel <sup>2</sup> .....cubic yards..    | 1,160           | 881.60      | 1.56        | 1.181   |
| Coal <sup>3</sup> .....tons..                      | 56              | 277.20      | .08         | .372    |
| Miscellaneous expenses <sup>4</sup> .....          |                 | 285.00      |             | .382    |
| Subsistence <sup>5</sup> .....                     |                 | 451.33      |             | .605    |
| Labor <sup>6</sup> .....                           |                 | 1,199.32    |             | 1.607   |
| Supervision <sup>7</sup> .....                     |                 | 500.00      |             | .684    |
| Total.....                                         |                 | 5,466.91    |             |         |

## Summary of costs (linear feet revetted, 1,070).

|                                           | Subaqueous work. |             | Upper bank work. |            | Grand total. | Total cost per linear foot. |
|-------------------------------------------|------------------|-------------|------------------|------------|--------------|-----------------------------|
|                                           | Per square.      | Total.      | Per square.      | Total.     |              |                             |
| Total field cost.....                     | \$9.87           | \$38,573.58 | \$12.29          | \$9,170.96 | \$48,744.54  | \$40.56                     |
| Office expenses.....                      |                  |             |                  |            | 1,432.33     | 12.87                       |
| Surveys <sup>8</sup> .....                |                  |             |                  |            | 504.00       |                             |
| Care of plant <sup>9</sup> .....          |                  |             |                  |            | 1,042.24     |                             |
| Repair of plant <sup>9</sup> .....        |                  |             |                  |            | 2,161.22     |                             |
| Depreciation of plant <sup>10</sup> ..... |                  |             |                  |            | 3,097.07     |                             |
| Total.....                                |                  |             |                  |            | 56,981.40    | 53.43                       |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> Includes wages of all employed on the work except those specified in 7.

<sup>7</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

<sup>8</sup> This item includes actual cost of survey work done on this revetment.

<sup>9</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>10</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The effective length of the revetment is 23,000 feet, all in good condition except that in places the upper slope needs to be attened and the pavement reinforced. The extreme upper end of the new ty pavement below a stage of 25 feet was not completed, on account of freezing weather preventing the laying of concrete, and the rapidly rising river when weather was favorable. This work will be completed as soon as the water falls.

Only nominal caving has occurred above the revetment and no caving below. Thorough repairs as noted above will probably be all that will be required the coming season.

The expenditures on this work to end of present year for new work amount \$1,260,752.63, and for maintenance \$350,114.32, a total of \$1,610,866.95.

*Local cooperation.*—The town of Greenville contributed \$42,277.10 in 1887 and in 1917 contributed \$35,500 for use in connection with revetment extension and construction of graded and paved slope for use as wharf.

*Terminal facilities.*—The slope on a frontage of about 600 feet has been graded to a 7 horizontal to 1 vertical slope, and paved with concrete suitable for traffic; pavement extending from low-water line to top of levee. Pavement to be used in connection with wharf boat or other landing facilities not yet provided. No connections with railroads have been made.

*Effect of improvement.*—The bank in this bend as far as revetted has been held, and the channel has been permanently located. The entire city of Greenville has been protected; confidence in the stability of the river bank has been restored, permitting the city to grow normally without fear of destruction and further expensive retirements of the controlling levee line have been made unnecessary.

*Proposed operations.*—It is proposed to make such repairs and extensions as may be necessary for maintenance.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(f) *Vaocluse, Ark.*

*Location and description.*—Four hundred and eighty-seven miles below Cairo right bank. Bank revetment.

*Original condition.*—The levee at this point was built near the lower end of Lake Chicot and could not be set back without great cost. Caving has been in progress since the earliest surveys, 1879–80, and had caused the bank to approach so close to the levee as to endanger its further life unless revetment was placed.

*Previous projects.*—None.

*Existing project.*—The present project is to protect the levee by means of continuous bank revetment.

*Operations and results during the present year.*—None.

*Condition at end of year.*—Effective length of the revetment is 3,925 feet, all in good condition except upper slope needs to be flattened in places and pavement reinforced. The expenditures on this work to end of present year for new work amount to \$161,042, and for maintenance, \$23,324.60, a total of \$184,366.60.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The work accomplished has protected the bank thus obviating the necessity of building a new and expensive loop, and has permanently located the channel.

*Proposed operations.*—It is proposed to make such repairs and extensions as may be necessary for maintenance.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(g) *Longwood, Miss.*

*Location and description.*—Five hundred miles below Cairo, left bank. Bank revetment.

*Original condition.*—Caving has been in progress since the earliest surveys—1879–80. In 1904 the Longwood Levee, one of the largest on the river, was threatened, and careful investigation proved that bank revetment would be cheaper than a relocation of the levee.

*Previous projects.*—None.

*Existing project.*—To protect the large and important levee line at this locality, by bank revetment.

*Operation and results during present year.*—None.

*Condition at end of year.*—The effective length of the work is 4,200 feet, all in good condition and shielded from the direct flow of the main current of the river by a sand bar which has formed opposite the work.

The expenditures on this work to end of present year all for new work amount to \$153,607.08.

*Local cooperation.*—The Board of Mississippi Levee Commissioners contributed \$11,009.45 in 1905.

*Terminal facilities.*—None.

*Effect of improvement.*—The caving which had been proceeding for more than 25 years was effectively checked. The construction of a levee loop estimated to cost \$793,000 was obviated with an expenditure of a little over \$150,000. The channel has been permanently located.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(h) *Grand Lake, Ark.*

*Location and description.*—Five hundred and ten miles below Cairo, right bank. Bank revetment.

*Original condition.*—The levee at this point was built across the bed of Grand Lake, where a new loop would have been very expensive. Caving has been in progress since the earliest surveys—1879-80, and by 1911 had so reduced the distance between the bank and the levee as to make it essential to either revet the bank or build a new levee.

*Previous projects.*—None.

*Existing project.*—To protect the levee and fix the channel at this point by means of continuous bank revetment.

*Operations and results during the present year.*—The break in the upper bank paving between ranges 76 and 80 was repaired, which required the following work: 933.1 squares of subaqueous willow mats and 272 squares of upper bank pavement with stone. An extension of 2,000 feet downstream was included in the project for this year's work, but owing to delays experienced at other points on account of severe freezing weather in December and January, and to the fact that a part of the outfit and organization assigned to do this work was loaned to the New Orleans engineering district for emergency work at the Passes, it was impossible to start work on the extension.

The amount expended during the year was \$13,934.08, all of which was for maintenance. Details of costs of work are given in the following tables, and location of work is shown on accompanying plate No. 6.

GRAND LAKE REVETMENT (510 R.), THIRD DISTRICT—REPAIR WORK.

*Mattresses, total area 933 squares (connecting 100 per cent).*

BUILDING WILLOW MATS.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$917.93    |             | \$0.984 |
| 1/4 inch strand <sup>2</sup> ..... pounds.....     | 5,000           | 340.00      | 5.36        | .375    |
| 1/2 inch strand <sup>2</sup> ..... do.....         | 3,400           | 193.80      | 3.70        | .208    |
| Brush and poles <sup>2</sup> ..... cords.....      | 1,516           | 2,334.64    | 1.62        | 2.50    |
| Coal <sup>3</sup> ..... tons.....                  | 8.6             | 42.57       | .009        | .046    |
| Miscellaneous expenses.....                        |                 | 239.45      |             | .256    |
| Subsistence <sup>4</sup> .....                     |                 | 420.66      |             | .450    |
| Steamboat expenses <sup>5</sup> .....              |                 | 125.00      |             | .134    |
| Labor <sup>6</sup> .....                           |                 | 738.79      |             | .792    |
| Supervision <sup>7</sup> .....                     |                 | 637.59      |             | .683    |
| Total.....                                         |                 | 5,990.43    |             |         |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This item is the cost of the served ration.

<sup>5</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>6</sup> Includes wages of all employed on the work except those specified in 7.

<sup>7</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## GRAND LAKE REVETMENT (510 R.), THIRD DISTRICT—REPAIR WORK—Continued.

*Mattresses, total area 933 squares (connecting 100 per cent)*—Continued.

## BALLASTING AND SINKING MATS.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$917.94    |             | \$0.984 |
| Stone <sup>2</sup> ..... tons.....                 | 1,147           | 2,867.50    | 1.23        | 3.073   |
| Coal <sup>3</sup> ..... do.....                    | 11.2            | 54.54       | .012        | .058    |
| Miscellaneous expenses <sup>4</sup> .....          |                 | 125.00      |             | .134    |
| Subsistence <sup>5</sup> .....                     |                 | 68.67       |             | .074    |
| Steamboat expenses <sup>6</sup> .....              |                 | 175.00      |             | .188    |
| Labor <sup>7</sup> .....                           |                 | 126.80      |             | .136    |
| Supervision <sup>8</sup> .....                     |                 | 270.00      |             | .289    |
| Total.....                                         |                 | 4,605.45    |             |         |

*Grading (1,205 squares).*

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>3</sup> ..... tons.....         | 17.6            | \$87.12     | 0.014       | \$0.072 |
| Oil <sup>3</sup> .....                    |                 | 32.75       |             | .027    |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 22.50       |             | .019    |
| Subsistence <sup>5</sup> .....            |                 | 209.33      |             | .174    |
| Labor <sup>7</sup> .....                  |                 | 524.53      |             | .435    |
| Total.....                                |                 | 876.23      |             |         |

*Paving (272 squares).*

|                                           | Quantity used.  |             | Per square. |        |
|-------------------------------------------|-----------------|-------------|-------------|--------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Stone <sup>2</sup> ..... tons.....        | 633             | \$1,582.50  | 2.33        | \$5.82 |
| Coal <sup>3</sup> ..... do.....           | 3.7             | 13.32       | .013        | .067   |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 75.00       |             | .276   |
| Subsistence <sup>5</sup> .....            |                 | 96.67       |             | .355   |
| Labor <sup>7</sup> .....                  |                 | 153.63      |             | .565   |
| Supervision <sup>8</sup> .....            |                 | 130.00      |             | .473   |
| Total.....                                |                 | 2,056.12    |             |        |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## GRAND LAKE REVETMENT (510 R.), THIRD DISTRICT—REPAIR WORK—continued.

*Summary of costs—Repair work.*

|                                          | Subaqueous work. |             | Upper bank work. |            | Grand total |
|------------------------------------------|------------------|-------------|------------------|------------|-------------|
|                                          | Per square.      | Total.      | Per square.      | Total.     |             |
| Total field cost.....                    | \$11.36          | \$10,595.88 | \$10.78          | \$2,932.35 | \$13,528.23 |
| Office expenses.....                     |                  |             |                  |            | 405.85      |
| Surveys <sup>1</sup> .....               |                  |             |                  |            | 112.00      |
| Care of plant <sup>2</sup> .....         |                  |             |                  |            | 463.21      |
| Repair of plant.....                     |                  |             |                  |            | 960.53      |
| Depreciation of plant <sup>3</sup> ..... |                  |             |                  |            | 1,276.46    |
| Total.....                               |                  |             |                  |            | 16,746.28   |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.

<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; per cent for all plants with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The present effective length of the revetment is 3,500 linear feet, all in good condition except about 300 feet at lower end, where excessive flanking has occurred, due to rapid downstream caving. The extension downstream of 2,000 feet already provided for will be completed this season. An additional 1,000 feet should also be placed in order to effectively protect the large levee dike covering the head of Grand Lake. The expenditures on this work to the end of the present year for new work amount to \$259,903.66, and for maintenance \$20,457.08, a total of \$280,360.74.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The work accomplished has permanently fixed the channel, protected the bank, and obviated the necessity of building a new and costly levee.

*Proposed operations.*—It is proposed to make necessary repairs and extend revetment downstream 2,000 feet.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(i) *Princeton, Miss.*

*Location and description.*—Five hundred and fourteen miles below Cairo, ft bank. Bank revetment.

*Original condition.*—The controlling levee line at this point could not again be retired without crossing the bed of Lake Jackson. Caving has been in progress since the earliest surveys—1879–80. In 1917 the distance from levee to shore line was so reduced as to make the revetment of the bank necessary in order to save the levee.

*Previous projects.*—None.

*Existing project.*—To protect the levee and fix the channel in this bend by means of continuous bank revetment.

*Operations and results during the present year.*—Work of manufacturing the new type of reinforced concrete subaqueous mats to be used at this point was commenced in October and continued until 3,129 squares were loaded on barges, which was sufficient to place mats along 1,000 linear feet. During December and January this work was forced to suspend on account of the severe freezing winter weather, conditions making the manufacture of concrete blocks impracticable. Work of sinking the blocks along a reach of about 200 feet which had been previously graded and prepared was commenced and 1,414 squares were sunk in place covering a reach of about 700 feet, which covered the graded bank that had not caved off in advance of the sinking operations. The total cost of work amounts to \$30,403.35, all of which was for new construction. Details of costs and expenditures are given in the tables following, and the location of the work is shown on accompanying plate No. 7.

## PRINCETON REVETMENT (514 L.), THIRD DISTRICT—NEW WORK.

*Mattresses, total area 1,414 squares).*BUILDING CONCRETE MATS (3,129 SQUARES).<sup>1</sup>

|                                           | Quantity used.  |             | Per square |        |
|-------------------------------------------|-----------------|-------------|------------|--------|
|                                           | Total quantity. | Total cost. | Quantity.  | Cost.  |
| Concrete mats <sup>2</sup> .....squares.. | 3,129           | \$20,025.60 | .....      | \$6.40 |

## SINKING CONCRETE MATS.

|                                                       |        |          |      |       |
|-------------------------------------------------------|--------|----------|------|-------|
| Mobilization and demobilization <sup>3</sup> .....    |        | 2,295.67 |      | 1.623 |
| $\frac{3}{4}$ -inch strand <sup>2</sup> .....pounds.. | 21,210 | 1,537.73 | 15.0 | 1.088 |
| $\frac{3}{4}$ -inch clips <sup>2</sup> .....do.....   | 9,900  | 673.20   | 7.00 | .476  |
| Coal <sup>4</sup> .....tons.....                      | 41     | 213.25   | .3   | .151  |
| Miscellaneous expenses <sup>5</sup> .....             |        | 475.00   |      | .336  |
| Subsistence <sup>6</sup> .....                        |        | 394.67   |      | .278  |
| Steamboat expenses <sup>7</sup> .....                 |        | 100.00   |      | .071  |
| Labor <sup>8</sup> .....                              |        | 675.75   |      | .477  |
| Supervision <sup>9</sup> .....                        |        | 1,198.83 |      | .847  |
| Total.....                                            |        | 7,564.10 |      |       |

## Grading (1,200 squares).

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>4</sup> .....tons..             | 97.3            | \$481.63    | 0.08        | \$0.401 |
| Oil <sup>4</sup> .....                    |                 | 14.60       |             | .012    |
| Miscellaneous expenses <sup>5</sup> ..... |                 | 126.50      |             | .105    |
| Subsistence <sup>6</sup> .....            |                 | 204.67      |             | .220    |
| Labor <sup>8</sup> .....                  |                 | 1,040.72    |             | .867    |
| Total.....                                |                 | 1,928.12    |             |         |

<sup>1</sup> For detailed statement of costs of building concrete mats see Ashbrook Neck revetment.<sup>2</sup> The reported cost of the material is the cost delivered on the job.<sup>3</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.<sup>4</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.<sup>5</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.<sup>6</sup> This item is the cost of the served ration.<sup>7</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.<sup>8</sup> Includes wages of all employed on the work except those specified in 9.<sup>9</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

PRINCETON REVETMENT (514 L.), THIRD DISTRICT—NEW WORK—continued.

*Summary of costs (linear feet revetted, 700)—not complete.*

|                                          | Subaqueous work. |             | Upper bank work. |            | Grand total. |
|------------------------------------------|------------------|-------------|------------------|------------|--------------|
|                                          | Per square.      | Total.      | Per square.      | Total.     |              |
| total field cost.....                    | \$19.51          | \$27,589.70 | \$1.61           | \$1,928.12 | \$29,517.82  |
| office expenses.....                     |                  |             |                  |            | 885.53       |
| surveys <sup>1</sup> .....               |                  |             |                  |            | 84.00        |
| care of plant <sup>2</sup> .....         |                  |             |                  |            | 485.48       |
| repair of plant.....                     |                  |             |                  |            | 1,006.72     |
| depreciation of plant <sup>3</sup> ..... |                  |             |                  |            | 1,442.66     |
| Total.....                               |                  |             |                  |            | 33,422.21    |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 1 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—Mats were sunk along a reach of 700 feet, but the upper bank pavement could not be placed, and as a consequence, a portion of the grade above the mats has been lost on account of wave wash. The shore line continues to cave rapidly above and below the mats that were placed. Just as soon as the stage of river permits, work of constructing 3,000 feet of revetment will be completed which will protect the controlling levee line. There have been no expenditures on this work prior to the present year. Expenditures for this year are shown in the preceding paragraph.

*Local cooperation.*—None.*Terminal facilities.*—None.*Effect of improvement.*—Work just commenced, no effect as yet.*Proposed operations.*—It is proposed to complete the construction of about 100 feet of standard bank revetment.*Recommended modifications of project.*—None.*References to published articles not previously reported.*—None.*(j) Lake Providence Reach.**Location and description.*—Five hundred and seventeen to five hundred and eighty miles below Cairo. Bank revetment.*Original condition.*—This and Plum Point Reach were originally selected by the commission for improvement, on account of the exceptional difficulties encountered there. Caving was excessive; the channel was not clearly defined, being divided into numerous branches by islands, and depths as small as 4½ feet were occasionally found on its crossings.*Previous projects.*—The original project adopted in 1881 provided for securing a low-water channel with an approximately uniform width of 3,000 feet. In constructing contraction works, closing all chutes, and holding caving banks. In 1896 due to the development of hydraulic dredging, the project for the reach as a whole was definitely abandoned, with the exception of repairs to revetments.*Existing project.*—Repairs to revetments.*Operations and results during the present year.*—None.*Condition at end of year.*—A total of 23,900 feet of effective revetment is in place at Louisiana Bend, La., and Lake Providence, La., all in good condition, the reaches are covered by towheads or bars and not subject to the direct attack from the river.

The total expenditures on this work aggregate \$3,943,668.70, which includes both new work and maintenance.

*Local cooperation.*—None.*Terminal facilities.*—None.*Effect of improvement.*—Caving was effectively checked at Louisiana Bend and in the bend above Lake Providence. The channel of the river was stabilized and depths on all crossings increased.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(k) *Fitlers Bend, Miss.*

*Location and description.*—Five hundred and fifty miles below Cairo, left bank. Bank revetment.

*Original condition.*—Caving has been in progress since the earliest surveys—1879–80. In 1906 the large levee at Fitlers became endangered from caving, and investigations showed revetment to be cheaper than a relocation of the levee.

*Previous projects.*—None.

*Existing project.*—To fix the channel, and prevent the destruction of the controlling levee line at this point by bank revetment.

*Operations and results during the present year.*—Work was commenced at this point early in July, and all pavement and work remaining from previous season was completed. Channel mats aggregating 3,665 feet in length were constructed and sunk in place reinforcing previous work. The upper bank was graded where failures had occurred, to a slope of 3 to 4 to 1, and an extra heavy concrete pavement connecting with new mats was laid, extending well over the soft sandy stratus which had previously been the cause of bank failures. All the work was made extra heavy and thorough precautions taken to make the new work effective. Repairs to the upper and lower end of the revetment were made, restoring a length of 4,750 feet as effective revetment previously reported destroyed. The work done is summarized as follows:

|                                     | Squares. |
|-------------------------------------|----------|
| Willow subaqueous mats placed.....  | 9,335    |
| Upper bank paved with concrete..... | 2,806    |

The amount expended during the year was \$120,128.67, all of which is charged to maintenance. Details of costs of work are given in the following tables, and location of work is shown on accompanying Plate No. 8:

FITLERS BEND, MISS. (550 L.), THIRD DISTRICT—NEW WORK.

*Mattresses, total area 9,335 squares (channel, 86 per cent; connecting, 14 per cent).*

BUILDING WILLOW MATS.

|                                                        | Quantity used.  |             | Per square |         |
|--------------------------------------------------------|-----------------|-------------|------------|---------|
|                                                        | Total quantity. | Total cost. | Quantity.  | Cost.   |
| Mobilization and demobilization <sup>1</sup> .....     |                 | \$1,466.54  |            | \$0.157 |
| $\frac{3}{4}$ -inch strand <sup>2</sup> ..... pounds.. | 53,735          | 3,868.92    | 5.76       | .414    |
| $\frac{1}{2}$ -inch strand <sup>2</sup> ..... do.....  | 88,230          | 5,989.64    | 9.45       | .642    |
| $\frac{1}{4}$ -inch strand <sup>2</sup> ..... do.....  | 31,602          | 1,801.31    | 3.37       | .193    |
| $\frac{3}{4}$ -inch clips <sup>2</sup> ..... do.....   | 500             | 47.50       | .054       | .006    |
| Staples <sup>2</sup> ..... number..                    | 1,252           | 46.32       | .13        | .005    |
| Spikes <sup>2</sup> ..... do.....                      | 1,000           | 31.00       | .107       | .008    |
| Brush and poles <sup>2</sup> ..... cords..             | 14,623          | 22,519.42   | 1.56       | 2.412   |
| Rope, manila <sup>2</sup> ..... pounds..               | 7,711.6         | 2,313.48    | .82        | .248    |
| Coal <sup>3</sup> ..... tons.....                      | 29.8            | 147.51      | .003       | .016    |
| Miscellaneous expenses <sup>4</sup> .....              |                 | 550.46      |            | .039    |
| Subsistence <sup>5</sup> .....                         |                 | 6,542.00    |            | .701    |
| Steamboat expenses <sup>6</sup> .....                  |                 | 800.00      |            | .086    |
| Labor <sup>7</sup> .....                               |                 | 10,210.92   |            | 1.092   |
| Supervision <sup>8</sup> .....                         |                 | 2,879.71    |            | .309    |
| Total.....                                             |                 | 59,214.73   |            |         |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

## FILTERS BEND, MISS. (550 L.), THIRD DISTRICT—NEW WORK—continued.

Mattresses, total area 9,335 squares (channel, 86 per cent; connecting, 14 per cent)—Continued.

## BALLASTING AND SINKING.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$733.27    |             | \$0.079 |
| Stone <sup>2</sup> .....tons.....                  | 8,773           | 21,932.50   | 0.94        | 2.349   |
| Rope, manila <sup>2</sup> .....pounds.....         | 7,711.6         | 2,313.48    | .83         | .248    |
| Coal <sup>3</sup> .....tons.....                   | 12.6            | 62.37       | .001        | .007    |
| Miscellaneous expenses <sup>4</sup> .....          |                 | 385.00      |             | .041    |
| Subsistence <sup>5</sup> .....                     |                 | 2,212.00    |             | .237    |
| Teamboat expenses <sup>6</sup> .....               |                 | 600.00      |             | .064    |
| Labor <sup>7</sup> .....                           |                 | 3,406.93    |             | .365    |
| Supervision <sup>8</sup> .....                     |                 | 1,250.00    |             | .134    |
| Total.....                                         |                 | 32,895.55   |             |         |

## Grading (2,870 squares).

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal <sup>3</sup> .....tons.....          | 139             | \$688.05    | 0.048       | \$0.239 |
| Oil <sup>3</sup> .....                    |                 | 32.50       |             | .011    |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 225.00      |             | .078    |
| Subsistence <sup>5</sup> .....            |                 | 2,099.80    |             | .732    |
| Labor <sup>7</sup> .....                  |                 | 4,091.57    |             | 1.426   |
| Total.....                                |                 | 7,136.92    |             |         |

## Paving (2,806 squares).

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$733.27    |             | \$0.258 |
| Gravel <sup>2</sup> .....sacks.....                | 10,181          | 4,988.69    | 3.62        | 1.778   |
| Sand and gravel <sup>2</sup> .....cubic yards..... | 4,063           | 3,087.88    | 1.45        | 1.100   |
| Coal <sup>3</sup> .....tons.....                   | 9.2             | 45.54       | .003        | .016    |
| Miscellaneous expenses <sup>4</sup> .....          |                 | 175.00      |             | .062    |
| Subsistence <sup>5</sup> .....                     |                 | 2,961.37    |             | 1.055   |
| Labor <sup>7</sup> .....                           |                 | 4,640.83    |             | 1.654   |
| Supervision <sup>8</sup> .....                     |                 | 750.00      |             | .260    |
| Total.....                                         |                 | 17,382.58   |             |         |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters to a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and mud pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

FILTERS BEND, MISS. (550 L.), THIRD DISTRICT—NEW WORK—continued.

*Summary of costs (linear feet revetted, 4,750).*

|                                          | Subaqueous work. |               | Upper bank work. |               | Grand total.   | Total cost per linear foot. |
|------------------------------------------|------------------|---------------|------------------|---------------|----------------|-----------------------------|
|                                          | Per square.      | Total.        | Per square.      | Total.        |                |                             |
| Total field cost.....                    | \$9. 87          | \$92, 110. 28 | \$8. 54          | \$24, 519. 50 | \$116, 629. 78 | \$24.                       |
| Office expenses.....                     |                  |               |                  |               | 3, 498. 89     |                             |
| Surveys <sup>1</sup> .....               |                  |               |                  |               | 168. 00        | 3.                          |
| Care of plant <sup>2</sup> .....         |                  |               |                  |               | 2, 213. 63     |                             |
| Repair of plant.....                     |                  |               |                  |               | 4, 590. 29     |                             |
| Depreciation of plant <sup>3</sup> ..... |                  |               |                  |               | 6, 577. 99     |                             |
| Total.....                               |                  |               |                  |               | 133, 678. 58   | 28.                         |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The present effective length is 13,200 linear feet all in good condition except about 750 squares of upper bank pavement, the completion of which was prevented on account of freezing weather in December and January and rapid rise in river after weather became warm enough to lay concrete. This work will be completed just as soon as the river reaches a stage at which the work can be done. Only nominal caving has occurred below the revetment.

The expenditures on this work to the end of the present year for new work amount to \$501,701.90, and for maintenance, \$272,280.36, a total of \$773,982.26.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—Caving has been effectively checked along the full reach revetted, and the channel has been fixed in position. The relocation of a long line of levee has been obviated.

*Proposed operations.*—It is proposed to make repairs and extensions as may be necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(1) *Cottonwood, Miss.*

*Location and description.*—Five hundred and fifty-eight miles below Cairo left bank. Bank revetment.

*Original condition.*—Prior to 1913 this bank had been relatively stable for many years, but following the 1913 flood serious caving set in, which amounted to 400 feet in 1914, 1,100 feet in 1915, and 1,500 feet in 1916. In 1915 a new levee was constructed about 1,000 feet back of the old levee, but the caving of the following season destroyed a considerable portion of the work and it became evident that it would be necessary either to fix the channel by means of revetment or else build a levee across the point and throw out a large area of land. Revetment was therefore decided upon.

*Previous projects.*—None.

*Existing project.*—To protect the bank, fix the channel in position, and protect the levee by means of continuous revetment along the caving bank in this bend.

*Operations and results during the present year.*—The uncompleted pavement of the previous year was completed and two channel mats were built and sunk together with the necessary connecting mats, making extensions of 1,000 feet upstream and 1,000 feet downstream. All work was completed with the exception of a short reach of upper bank pavement which lacked about 15 feet.

in height, the laying of which was prevented by severe freezing weather in December and January. The work done is summarized as follows:

|                                     |                |
|-------------------------------------|----------------|
| Willow subaqueous mats placed.....  | Squares. 7,332 |
| Upper bank paved with concrete..... | 4,337          |

A levee dike at the lower end of the revetment was also constructed, containing 29,703 cubic yards of earthwork, at a cost of \$9,801.99. This was placed in order to prevent the river flanking the revetment by scouring a channel through the levee borrow pits. The amount expended was \$115,143.92, all of which was for new work. Details of costs of work are given in the following tables, and location of work is shown on accompanying plate No. 9.

COTTONWOOD, MISS. (558 L.), THIRD DISTRICT—NEW WORK.

Mattresses, total area, 7,332 squares (channel, 77 per cent; connecting, 23 per cent).

BUILDING WILLOW MATS.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$2,005.48  |             | \$0.274 |
| Each strand <sup>2</sup> .....pounds.....          | 23,113          | 1,317.44    | 3.15        | .180    |
| Each strand <sup>2</sup> .....do.....              | 41,230          | 2,803.64    | 5.62        | .382    |
| Each clip <sup>2</sup> .....do.....                | 29,367          | 2,114.42    | 4.01        | .288    |
| Each clip <sup>2</sup> .....do.....                | 568             | 113.03      | .01         | .015    |
| Each clip <sup>2</sup> .....number.....            | 940             | 34.78       | .03         | .005    |
| Each clip <sup>2</sup> .....cords.....             | 13,648          | 21,017.92   | 1.80        | 2.867   |
| Each clip <sup>2</sup> .....pounds.....            | 7,712           | 2,313.48    | 1.05        | .316    |
| Each clip <sup>2</sup> .....tons.....              | 46.7            | 231.16      | .006        | .032    |
| Cellaneous expenses <sup>4</sup> .....             |                 | 426.24      |             | .058    |
| Assistance <sup>5</sup> .....                      |                 | 4,036.00    |             | .550    |
| Boat expenses <sup>6</sup> .....                   |                 | 450.00      |             | .061    |
| For <sup>7</sup> .....                             |                 | 7,574.70    |             | 1.033   |
| Revision <sup>8</sup> .....                        |                 | 1,838.33    |             | .251    |
| Total.....                                         |                 | 46,276.62   |             |         |

BALLASTING AND SINKING.

|                                           |       |             |       |         |
|-------------------------------------------|-------|-------------|-------|---------|
| Each strand <sup>2</sup> .....tons.....   | 7,098 | \$17,745.00 | 0.096 | \$2.420 |
| Each strand <sup>2</sup> .....pounds..... | 7,712 | 2,313.48    | 1.05  | .316    |
| Each strand <sup>2</sup> .....tons.....   | 52.8  | 261.36      | .007  | .036    |
| Cellaneous expenses <sup>4</sup> .....    |       | 300.00      |       | .041    |
| Assistance <sup>5</sup> .....             |       | 896.67      |       | .122    |
| Boat expenses <sup>6</sup> .....          |       | 550.00      |       | .075    |
| For <sup>7</sup> .....                    |       | 1,947.54    |       | .266    |
| Revision <sup>8</sup> .....               |       | 1,238.33    |       | .169    |
| Total.....                                |       | 25,252.38   |       |         |

includes in each case the cost of assembling and moving plant and material, either from winter quarters or previous job to the particular job to which the item applies, and this particular job's pro rata of the reported cost of the material is the cost delivered on the job.

These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

This includes all tools, expendable material, and other articles which are not regarded as replacement material, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats, quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

This item is the cost of the served ration.

This item includes all the expenses of operating the tenders, and no others, and excludes all expenses for general towing service, and inspection and survey boats.

This includes wages of all employed on the work except those specified in 8.

This includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

COTTONWOOD, MISS. (558 L.), THIRD DISTRICT—NEW WORK—continued.

*Grading (5,471 squares).*

|                                           | Quantity used.  |             | Per square. |       |
|-------------------------------------------|-----------------|-------------|-------------|-------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost. |
| Coal <sup>1</sup> .....tons..             | 174.6           | \$864.27    | 0.032       | \$0.1 |
| Oil <sup>1</sup> .....                    |                 | 35.40       |             | .0    |
| Miscellaneous expenses <sup>2</sup> ..... |                 | 250.00      |             | .0    |
| Subsistence <sup>3</sup> .....            |                 | 2,796.00    |             | .5    |
| Labor <sup>4</sup> .....                  |                 | 5,327.42    |             | .9    |
| Total.....                                |                 | 9,273.09    |             |       |

*Paving (4,337 squares).*

|                                           | Quantity used.  |             | Per square. |       |
|-------------------------------------------|-----------------|-------------|-------------|-------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost. |
| Cement <sup>5</sup> .....sacks..          | 14,777          | \$7,130.73  | 3.40        | \$1.6 |
| Sand and gravel.....cubic yards..         | 7,171           | 5,449.96    | 1.65        | 1.2   |
| Coal <sup>1</sup> .....tons..             | 22.4            | 110.88      | .005        | .0    |
| Oil <sup>1</sup> .....                    |                 | 18.75       |             | .0    |
| Miscellaneous expenses <sup>2</sup> ..... |                 | 150.00      |             | .0    |
| Subsistence <sup>3</sup> .....            |                 | 2,558.31    |             | .8    |
| Labor <sup>4</sup> .....                  |                 | 4,872.18    |             | 1.1   |
| Supervision <sup>6</sup> .....            |                 | 638.32      |             | .1    |
| Total.....                                |                 | 20,929.13   |             |       |

*Summary of costs (linear feet revetted, 2,000).*

|                                          | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                          | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....                    | \$9.76           | \$71,529.00 | \$7.00           | \$30,202.22 | \$101,731.22 | \$50.88                     |
| Office expenses.....                     |                  |             |                  |             | 3,068.19     |                             |
| Surveys <sup>7</sup> .....               |                  |             |                  |             | 168.00       |                             |
| Care of plant <sup>8</sup> .....         |                  |             |                  |             | 1,888.50     |                             |
| Repair of plant.....                     |                  |             |                  |             | 3,916.07     |                             |
| Depreciation of plant <sup>9</sup> ..... |                  |             |                  |             | 5,611.83     |                             |
| Total.....                               |                  |             |                  |             | 116,383.81   | 58.69                       |

<sup>1</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>2</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement of plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are charged to plant.

<sup>3</sup> This item is the cost of the served ration.

<sup>4</sup> Includes wages of all employed on the work except those specified in 6.

<sup>5</sup> The reported cost of the material is the cost delivered on the job.

<sup>6</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

<sup>7</sup> This item includes actual cost of survey work done on this revetment.

<sup>8</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>9</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The present effective length of revetment is 9,900 feet; all in good condition except about 500 squares of concrete upper bank pavement left uncompleted on account of freezing weather in December and January, and which will be completed as soon as stage of river permits. Rapid caving continues above the revetment, and a further extension up stream of from 2,000 to 3,000 feet will be required this year in order to protect the controlling levee line.

The expenditures on this work to the end of the present year amount to \$325,717.58, all of which is for new work.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—Caving has been effectively stopped. The channel has been fixed in position. The controlling levee line has been saved from destruction.

*Proposed operations.*—It is proposed to make necessary repairs to maintain work in good condition and extend up stream 2,000 feet.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(m) *Albemarle Bend, Miss.*

*Location and description.*—Five hundred and sixty-eight miles below Cairo, left bank. Bank revetment.

*Original condition.*—The bank in this bend had caved back  $2\frac{1}{2}$  miles since the survey of 1879–80, and destroyed many miles of levees and thousands of acres of valuable land. On account of the proximity of Goose Lake, Five Mile Lake and Steele Bayou behind the existing levee, there was no suitable economical location for a new loop, and it therefore became necessary to take steps to prevent further caving in the bend.

*Previous projects.*—None.

*Existing project.*—To protect the levee in this bend by means of continuous bank revetment.

*Operations and results during the present year.*—None.

*Condition at end of year.*—Work is in good condition, except for minor breaks in upper bank work; effective length 13,720 feet. In 1913 the main channel of the river made a cut off through Newman's Towhead Chute, since which time the revetment is not subject to the action of the river except at high stages.

The expenditures on this work to the end of the present year for new work amount to \$486,033, and \$148,109.92+ for maintenance, a total of \$634,142.92.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The work accomplished has protected the bank, and obviated the necessity of building a new levee at great cost.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to maintain the work in good condition.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(n) *Delta Point, La.*

*Location and description.*—Five hundred and ninety-eight miles below Cairo, right bank. Bank revetment.

*Original condition.*—Succeeding the Centennial Cut-off in 1876, very rapid caving occurred on Delta Point and in the bend above, and the subsequent shoaling of the channel leading from the river along the Vicksburg front practically destroyed the harbor at Vicksburg for low-water commerce.

*Previous projects.*—In connection with the improvement of Vicksburg Harbor the protection of Delta Point with bank revetment was authorized in the river and harbor act approved June 18, 1873.

*Existing project.*—The river and harbor act approved August 2, 1882, placed this work under the supervision of the Mississippi River Commission. The continued protection of the point with bank revetment is proposed.

*Operations and results during the present year.*—None.

*Condition at end of year.*—The effective length of the revetment is 5,900 feet, all in good condition.

The expenditures on this work to the end of the present year for new work amount to \$420,546, and \$36,416.29+ for maintenance, a total of \$456,962.29.

*Local cooperation.*—None.

*Terminal facilities.*—Railway incline and cradle for transferring cars from bank to boats and vice versa, owned by the Mississippi & Louisiana Railway Transfer Co. (Vicksburg route).

*Effect of improvement.*—Delta Point has been held in exactly the same position as when work was commenced in 1879. The channel of the river has been prevented from being deflected farther away from Vicksburg Harbor and important railroad terminals and incline saved from destruction by caving bank.

*Proposed operations.*—Proposed to make necessary repairs to maintain work in good condition.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(c) Vicksburg Harbor, Miss.

*Location and description.*—Five hundred and ninety-nine miles below Cairo, left bank. Bank revetment.

*Original condition.*—Subsequent to the cut-off which occurred in 1876, and prior to the construction of the canal which diverted the Yazoo River along the Vicksburg front, this stretch of bank was not exposed to any current action, and even after the completion of the diversion canal, it suffered no damage until the excessively high floods of 1912 and 1913—although the original section of the canal prism had scoured out to some extent. During the 1912 and 1913 floods, unusually large amounts of water were discharged through the canal as a result of crevasses in the levee system, and caused serious caving along the bank just above the point where the canal enters the Mississippi. Further caving occurred during succeeding high water, resulting in heavy losses to the Vicksburg, Shreveport & Pacific Railway, which was compelled to relocate its tracks, and to the compress companies established on the bank. If permitted to continue, the caving would have compelled the railroad to abandon its present point for crossing the Mississippi, and would have destroyed considerable portions of the cotton sheds belonging to the compress companies. Revetment was therefore determined upon.

*Previous projects.*—None.

*Existing project.*—To protect the bank by revetment, and thus save valuable properties, of a more or less public nature, from serious loss or destruction.

*Operations and results during the present year.*—Work on the completion of the revetment as projected was resumed September 4, minor repairs were made to defects in the upper bank pavement of last year, and the full length of revetment as originally contemplated, embracing an extension of 2,500 feet up stream. All mats placed were of the reinforced concrete subaqueous type, and all upper bank pavement, with the exception of several very boggy reaches near the low waters edge which were covered with brush and stone, was of the standard concrete upper bank pavement type. A summary of work done is as follows:

|                                      | Squares. |
|--------------------------------------|----------|
| Concrete subaqueous mats placed..... | 3, 910   |
| Concrete upper bank pavement.....    | 3, 334   |
| Total.....                           | 7, 244   |

The cost of this work amounted to \$60,096.45, all charged to new construction. Details of costs and expenditures are given in the following tables, and location of work in accompanying plate No. 9.

VICKSBURG HARBOR, MISS. (599 L.), THIRD DISTRICT—NEW WORK.

BUILDING CONCRETE MATS.

|                             | Quantity used.  |               | Per square. |         |
|-----------------------------|-----------------|---------------|-------------|---------|
|                             | Total quantity. | Total cost.   | Quantity.   | Cost.   |
| Concrete mats.....squares.. | 3, 910          | \$25, 024. 00 | .....       | \$6. 40 |

VICKSBURG HARBOR, MISS. (599 L.), THIRD DISTRICT, NEW WORK—continued.

*Sinking concrete mats (3,910 squares).*

|                                                   | Quantity used.  |             | Per square. |         |
|---------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                   | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization <sup>1</sup> ..... |                 | \$1,705.04  | .....       | \$0.436 |
| nch strand <sup>2</sup> .....pounds..             | 59,500          | 4,313.75    | 12.4        | 1.103   |
| nch clips <sup>2</sup> .....do..                  | 21,900          | 1,489.20    | 5.60        | .381    |
| al <sup>3</sup> .....tons..                       | 77              | 381.15      | .02         | .098    |
| ellaneous expenses <sup>4</sup> .....             |                 | 626.34      | .....       | .160    |
| sistence <sup>5</sup> .....                       |                 | 960.00      | .....       | .246    |
| amboat expenses <sup>6</sup> .....                |                 | 500.00      | .....       | .128    |
| bor <sup>7</sup> .....                            |                 | 2,150.90    | .....       | .550    |
| ervision <sup>8</sup> .....                       |                 | 1,796.73    | .....       | .450    |
| Total.....                                        |                 | 13,922.21   | .....       | .....   |

*Grading (2,414 squares).*

|                                       | Quantity used.  |             | Per square. |         |
|---------------------------------------|-----------------|-------------|-------------|---------|
|                                       | Total quantity. | Total cost. | Quantity.   | Cost.   |
| l <sup>3</sup> .....tons..            | 122             | \$606.90    | 0.031       | \$0.250 |
| .....                                 |                 | 18.63       | .....       | .008    |
| ellaneous expenses <sup>4</sup> ..... |                 | 300.00      | .....       | .124    |
| sistence <sup>5</sup> .....           |                 | 1,216.00    | .....       | .504    |
| bor <sup>7</sup> .....                |                 | 2,237.33    | .....       | .927    |
| Total.....                            |                 | 4,375.86    | .....       | .....   |

*Concrete paving (3,334 squares).*

|                                            | Quantity used.  |             | Per square. |         |
|--------------------------------------------|-----------------|-------------|-------------|---------|
|                                            | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Bh and poles <sup>2</sup> .....cords..     | 206             | \$317.24    | 0.062       | \$0.095 |
| ent <sup>2</sup> .....sacks..              | 12,762          | 6,253.38    | 3.83        | 1.87    |
| and gravel <sup>2</sup> .....cubic yards.. | 5,615           | 4,267.40    | 1.66        | 1.28    |
| .....tons..                                | 47              | 232.65      | .012        | .070    |
| ellaneous expenses <sup>4</sup> .....      |                 | 200.00      | .....       | .060    |
| sistence <sup>5</sup> .....                |                 | 1,064.67    | .....       | .319    |
| r <sup>7</sup> .....                       |                 | 2,184.37    | .....       | .655    |
| urvision <sup>8</sup> .....                |                 | 207.20      | .....       | .062    |
| Total.....                                 |                 | 14,726.91   | .....       | .....   |

includes in each case the cost of assembling and moving plant and material, either from winter quarters or previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

The reported cost of the material is the cost delivered on the job.

These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

It includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats, quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be included to plant.

This item is the cost of the served ration.

This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

Includes wages of all employed on the work except those specified in 8.

Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

VICKSBURG HARBOR, MISS. (599 L.), THIRD DISTRICT, NEW WORK—continued.

*Summary of costs (linear feet revetted, 2,500).*

|                                          | Subaqueous work. |              | Upper bank work. |              | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|--------------|------------------|--------------|--------------|-----------------------------|
|                                          | Per square.      | Total.       | Per square.      | Total.       |              |                             |
| Total field cost.....                    | \$9. 10          | \$38,946. 21 | \$5. 73          | \$19,102. 77 | \$58,048. 98 | } \$23. 26                  |
| Office expenses.....                     |                  |              |                  |              | 1,747. 47    |                             |
| Surveys <sup>1</sup> .....               |                  |              |                  |              | 112. 00      |                             |
| Care of plant <sup>2</sup> .....         |                  |              |                  |              | 1,042. 25    |                             |
| Repair of plant.....                     |                  |              |                  |              | 2,161. 23    |                             |
| Depreciation of plant <sup>3</sup> ..... |                  |              |                  |              | 3,097. 11    | } 3. 26                     |
| Total.....                               |                  |              |                  |              | 66,209. 04   | 26. 48                      |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls, 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—The effective length of revetment placed is 4,300 feet, all in good condition. The original project is completed, and maintenance only will be required in the future.

The total expenditures on this work to end of present year amount to \$111,410.62, all for new construction.

*Local cooperation.*—None.

*Terminal facilities.*—Railway incline and cradle for transferring cars from bank to boats and vice versa, owned by the Louisiana & Mississippi Railway Transfer Co. (Vicksburg Route). Warehouses and switch tracks of the Yazoo & Mississippi Valley and Alabama & Vicksburg Railways run along the top of the bank along the entire Vicksburg Harbor front. Good landing facilities, but no mechanical means of transferring freight between cars and boats.

*Effect of improvement.*—The revetment protects the tracks of the Alabama & Vicksburg Railway from caving into the river. Also fixes the shore line and protects important cotton compresses and warehouse properties; and stabilizes the channel of the river.

*Proposed operations.*—It is proposed to make necessary repairs to maintain revetment in good condition.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

(p) Reid-Bedford Bend, La.

*Location and description.*—Six hundred and three miles below Cairo, right bank. Bank revetment.

*Original condition.*—Caving has progressed steadily since the surveys of 1879–80, and the bank receded about  $1\frac{1}{4}$  miles between that time and 1906, when the bank had approached so close to the levee as to threaten its existence. The land behind the levee is low and swampy and would have rendered the relocation of the levee expensive and difficult. The bend is also very difficult torevet on account of sloughing banks, where large sections settle slowly and slide out, and deep water and swift current close to the shore.

*Previous projects.*—None.

*Existing project.*—To protect the bank, fix the channel in position, and protect the levee by means of continuous revetment along the caving bank in front of the levee.

*Operations and results during the present year.*—Hydraulic grading for an extension of 3,000 feet was commenced early in September and completed grade for 2,000 feet was made before work was suspended. Work of building channel mats was commenced early in December, but owing to labor shortage and severe freezing winter weather in December and January, a length of only 460 feet

containing 1,155 squares was completed, and sunk prior to stopping of work by high stage of river early in February.

The cost of this work amounted to \$21,743.38, all of which was for new work. Details of costs and expenditures are given in the following tables; and location of work shown on accompanying plate No. 10.

REID-BEDFORD, LA. (603 R.), THIRD DISTRICT—NEW WORK.

*Mattresses, total area 1,155 squares (channel, 100 per cent).*

BUILDING WILLOW MATS.

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$1,954.80  |             | \$1.692 |
| 1/2-inch strand <sup>2</sup> .....pounds..         | 3,139           | 178.92      | 2.72        | .155    |
| 1-inch strand <sup>2</sup> .....do.....            | 14,041          | 954.79      | 12.16       | .827    |
| 1-inch strand <sup>2</sup> .....do.....            | 12,000          | 864.00      | 10.39       | .748    |
| 1-inch clips <sup>2</sup> .....do.....             | 25              | 2.38        | .02         | .002    |
| staples <sup>2</sup> .....number..                 | 348             | 12.87       | .30         | .011    |
| spikes <sup>2</sup> .....do.....                   | 300             | 9.30        | .26         | .008    |
| brush and poles <sup>2</sup> .....cords..          | 2,038           | 1,100.52    | 1.76        | .953    |
| coal <sup>3</sup> .....tons..                      | 14.8            | 73.26       | .013        | .064    |
| Miscellaneous expenses <sup>4</sup> .....          |                 | 373.54      |             | .323    |
| subsistence <sup>5</sup> .....                     |                 | 1,607.33    |             | 1.391   |
| teamboat expenses <sup>6</sup> .....               |                 | 375.00      |             | .325    |
| labor <sup>7</sup> .....                           |                 | 2,904.71    |             | 2.515   |
| supervision <sup>8</sup> .....                     |                 | 1,189.90    |             | 1.029   |
| Total.....                                         |                 | 11,600.42   |             |         |

BALLASTING AND SINKING.

|                                                    |      |            |      |         |
|----------------------------------------------------|------|------------|------|---------|
| Mobilization and demobilization <sup>1</sup> ..... |      | \$1,354.80 |      | \$1.173 |
| 1-ton <sup>2</sup> .....tons..                     | 956  | 2,390.00   | 0.83 | 2.07    |
| coal <sup>3</sup> .....do.....                     | 19.6 | 97.02      | .02  | .084    |
| Miscellaneous expenses <sup>4</sup> .....          |      | 250.00     |      | .216    |
| subsistence <sup>5</sup> .....                     |      | 251.33     |      | .217    |
| teamboat expenses <sup>6</sup> .....               |      | 225.00     |      | .194    |
| labor <sup>7</sup> .....                           |      | 546.54     |      | .473    |
| supervision <sup>8</sup> .....                     |      | 600.39     |      | .520    |
| Total.....                                         |      | 5,715.08   |      |         |

Grading (2,000 squares).

|                                           | Quantity used.  |             | Per square. |         |
|-------------------------------------------|-----------------|-------------|-------------|---------|
|                                           | Total quantity. | Total cost. | Quantity.   | Cost.   |
| coal <sup>3</sup> .....tons..             | 117.8           | \$583.11    | 0.06        | \$0.291 |
| oil <sup>3</sup> .....                    |                 | 46.35       |             | .023    |
| Miscellaneous expenses <sup>4</sup> ..... |                 | 150.00      |             | .075    |
| subsistence <sup>5</sup> .....            |                 | 791.33      |             | .396    |
| labor <sup>7</sup> .....                  |                 | 1,823.79    |             | .912    |
| supervision <sup>8</sup> .....            |                 | 400.00      |             | .200    |
| Total.....                                |                 | 3,794.58    |             |         |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or from a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This includes all tools, expendable material, and other articles which are not regarded as replacement plant, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be charged to plant.

<sup>5</sup> This item is the cost of the served ration.

<sup>6</sup> This item includes all the expenses of operating the tenders, and no others, and excludes all expenses of boats in general towing service, and inspection and survey boats.

<sup>7</sup> Includes wages of all employed on the work except those specified in 8.

<sup>8</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

REID-BEDFORD, LA. (603 R.), THIRD DISTRICT—NEW WORK—continued.

*Summary of costs—Work not completed.*

|                                          | Subaqueous work. |             | Upper-bank work. |            | Grand total. |
|------------------------------------------|------------------|-------------|------------------|------------|--------------|
|                                          | Per square.      | Total.      | Per square.      | Total.     |              |
| Total field cost.....                    | \$14.99          | \$17,315.50 | 1 1.90           | \$3,794.58 | \$21,110.08  |
| Office expenses.....                     |                  |             |                  |            | 633.30       |
| Surveys <sup>2</sup> .....               |                  |             |                  |            | 140.00       |
| Care of plant <sup>3</sup> .....         |                  |             |                  |            | 547.86       |
| Repair of plant.....                     |                  |             |                  |            | 1,136.03     |
| Depreciation of plant <sup>4</sup> ..... |                  |             |                  |            | 1,626.94     |
| Total.....                               |                  |             |                  |            | 25,194.21    |

<sup>1</sup> Grading only.<sup>2</sup> This item includes actual cost of survey work done on this revetment.<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>4</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—Present effective length of revetment is 7,230 feet, all in good condition except several points where sloughs in the upper bank need regrading, and pavement repaired. Work will be resumed as soon as stage of river permits, and the proposed 3,000-foot extension downstream completed. The expenditures on this work to end of present year for new work amount to \$417,864.52; for maintenance, \$46,428.76; total of \$464,293.28.

*Local cooperation.*—None.*Terminal facilities.*—None.*Effect of improvement.*—The work accomplished at this point has fixed the channel in location and protected the bank and an important line of levee, thus obviating the necessity of building a new and costly levee.*Proposed operations.*—Such work as may be necessary for maintenance, and an extension downstream of work started last season.*Recommended modifications of project.*—None.*References to published articles not previously reported.*—None.(q) *Red Fork, Ark.**Location and description.*—Arkansas River, 23 miles above mouth. Bank reventment.*Original condition.*—A rapidly caving bank threatened the destruction of a levee across the end of Lake Belcoe, the destruction of which would have necessitated building a loop of considerable length.*Previous projects.*—None.*Existing project.*—Adopted 1907, provides for the protection of levee between Lake Belcoe and river bank by means of bank protection where caving threatens the levee.*Operations and results during the present year.*—Work of completing a proposed extension of 4,000 feet at this point was in progress at date of last annual report. Work was continued and completed August 1. A total of 7,574 squares of subaqueous concrete mats were sunk, and 2,087 squares of upper bank paved with concrete. The cost of this work amounts to \$37,104.41, all of which is charged to new work. Details of costs and expenditures are given in the following tables, and location of work is shown on accompanying plate No. 11.

## RED FORK REVETMENT, ARKANSAS RIVER, THIRD DISTRICT.

*Mattresses, total area 2,983 squares.*

## BUILDING REINFORCED CONCRETE MATS.

|                                                   | Quantity used.  |             | Per square. |         |
|---------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                   | Total quantity. | Total cost. | Quantity.   | Cost.   |
| obilization and demobilization <sup>1</sup> ..... |                 | \$1,047.18  |             | \$0.351 |
| raft paper <sup>2</sup> ..... pounds.....         | 2,771           | 205.05      | 0.93        | .069    |
| tre mesh <sup>2</sup> ..... squares.....          | 1,389           | 1,583.46    |             | .531    |
| ush and poles <sup>2</sup> ..... cords.....       | 109             | 167.86      | .037        | .056    |
| ment <sup>2</sup> ..... sacks.....                | 8,041           | 3,940.09    | 2.61        | 1.321   |
| ad and gravel <sup>2</sup> ..... cubic yards..... | 3,060           | 2,325.60    | 1.03        | .779    |
| il <sup>3</sup> ..... tons.....                   | 18.6            | 92.07       | .006        | .031    |
| ssistence <sup>4</sup> .....                      |                 | 936.00      |             | .311    |
| amboat expenses <sup>5</sup> .....                |                 | 175.00      |             | .057    |
| oor <sup>6</sup> .....                            |                 | 1,298.53    |             | .435    |
| ervision <sup>7</sup> .....                       |                 | 313.69      |             | .105    |
| Total.....                                        |                 | 12,084.53   |             |         |

## SINKING CONCRETE MATS.

|                                                   |        |          |       |         |
|---------------------------------------------------|--------|----------|-------|---------|
| obilization and demobilization <sup>1</sup> ..... |        | \$523.59 |       | \$0.176 |
| ch strand <sup>2</sup> ..... pounds.....          | 42,080 | 3,050.80 | 14.11 | 1.023   |
| ch clips <sup>2</sup> ..... do.....               | 23,589 | 1,604.05 | 7.91  | .531    |
| il <sup>3</sup> ..... tons.....                   | 26     | 128.70   | .009  | .043    |
| ellaneous expenses <sup>5</sup> .....             |        | 314.60   |       | .105    |
| ssistence <sup>4</sup> .....                      |        | 931.33   |       | .312    |
| amboat expenses <sup>5</sup> .....                |        | 125.00   |       | .042    |
| oor <sup>6</sup> .....                            |        | 1,901.77 |       | .631    |
| ervision <sup>7</sup> .....                       |        | 156.69   |       | .053    |
| Total.....                                        |        | 8,736.53 |       |         |

## Grading (2,119 squares).

|                              | Quantity used.  |             | Per square. |         |
|------------------------------|-----------------|-------------|-------------|---------|
|                              | Total quantity. | Total cost. | Quantity.   | Cost.   |
| ssistence <sup>4</sup> ..... |                 | \$830.67    |             | \$0.392 |
| oor <sup>6</sup> .....       |                 | 1,193.58    |             | .563    |
| Total.....                   |                 | 2,024.25    |             |         |

includes in each case the cost of assembling and moving plant and material, either from winter quarters or previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

The reported cost of the material is the cost delivered on the job.

These items include only the coal and oil used on the graders, upper bank-paving machinery, and pumps. The coal used on tenders and towboats will not be included under this heading.

This item is the cost of the served ration.

This item includes all the expenses of operating the tenders, and no others, and excludes all expenses incurred in general towing service, and inspection and survey boats.

This includes wages of all employed on the work except those specified in 7.

This includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

This includes all tools, expendable material, and other articles which are not regarded as replacement material, and are not otherwise itemized. Articles such as ranges, furniture, and furnishings for boats and quarter boats, instruments, typewriters, and all articles used to replace plant or equipment are to be included to plant.

RED FORK REVETMENT, ARKANSAS RIVER, THIRD DISTRICT—continued.

*Concrete paving (2,286 squares).*

|                                                    | Quantity used.  |             | Per square. |         |
|----------------------------------------------------|-----------------|-------------|-------------|---------|
|                                                    | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization <sup>1</sup> ..... |                 | \$523.59    |             | \$0.229 |
| Cement <sup>2</sup> .....sacks..                   | 12,286          | 6,020.14    | 5.37        | 2.633   |
| Sand and gravel <sup>2</sup> .....cubic yards..    | 4,371           | 3,321.96    | 1.91        | 1.453   |
| Coal <sup>3</sup> .....tons..                      | 43              | 212.85      | .019        | .093    |
| Subsistence <sup>4</sup> .....                     |                 | 1,188.67    |             | .520    |
| Labor <sup>5</sup> .....                           |                 | 1,794.12    |             | .785    |
| Supervision <sup>6</sup> .....                     |                 | 156.69      |             | .069    |
| Total.....                                         |                 | 13,218.02   |             |         |

*Summary of costs (linear feet reveted, 3,000).*

|                                           | Subaqueous work. |             | Upper bank work. |             | Grand total. | Total cost per linear foot. |
|-------------------------------------------|------------------|-------------|------------------|-------------|--------------|-----------------------------|
|                                           | Per square.      | Total.      | Per square.      | Total.      |              |                             |
| Total field cost.....                     | \$6.90           | \$20,821.06 | \$6.67           | \$15,242.27 | \$36,063.33  | <sup>7</sup> \$18.25        |
| Office expenses.....                      |                  |             |                  |             | 1,041.05     |                             |
| Surveys <sup>8</sup> .....                |                  |             |                  |             | 112.00       |                             |
| Care of plant <sup>9</sup> .....          |                  |             |                  |             | 654.73       | 3.37                        |
| Repair of plant.....                      |                  |             |                  |             | 1,357.81     |                             |
| Depreciation of plant <sup>10</sup> ..... |                  |             |                  |             | 1,945.63     |                             |
| Total.....                                |                  |             |                  |             | 41,174.55    | 21.62                       |

<sup>1</sup> Includes in each case the cost of assembling and moving plant and material, either from winter quarters or a previous job to the particular job to which the item applies, and this particular job's pro rata of the cost of laying up the plant at the end of the season.

<sup>2</sup> The reported cost of the material is the cost delivered on the job.

<sup>3</sup> These items include only the coal and oil used on the graders, upper bank-paving machinery, and sand pumps. The coal used on tenders and towboats will not be included under this heading.

<sup>4</sup> This item is the cost of the served ration.

<sup>5</sup> Includes wages of all employed on the work except those specified in 6.

<sup>6</sup> Includes salaries of superintendents, junior engineers, overseers, foremen, timekeepers, and inspectors.

<sup>7</sup> Based on totals of last year and this and total of 4,200 linear feet revetted.

<sup>8</sup> This item includes actual cost of survey work done on this revetment.

<sup>9</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>10</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plant with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of year.*—Total effective length of revetment is 4,200 linear feet, all in good condition. Caving continues rapid below the revetment, and a further extension of about 1,000 feet downstream should be built in order to effectively protect the controlling levee line.

The expenditures on this work to end of present year for new work amount to \$83,505.88, for maintenance \$14,728.35, a total of \$98,234.23.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The revetment has fixed the channel in location and prevented the Lake Belcoe Levee from being breached by the caving river bank, and thus obviated the necessity of a new and expensive levee.

*Proposed operations.*—Proposed to make necessary repairs and extensions to maintain work in good condition.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Mississippi River Commission, Third District—Data of cost of revetment,  
June 1, 1917, to May 31, 1918.*

| Location.                  | Expended<br>as per<br>financial<br>statement. | Debits to<br>material<br>on hand. | Credit by<br>material<br>on hand. | Total<br>field<br>cost. | Unit<br>field cost. |                        | Unit<br>overhead cost. |                        |
|----------------------------|-----------------------------------------------|-----------------------------------|-----------------------------------|-------------------------|---------------------|------------------------|------------------------|------------------------|
|                            |                                               |                                   |                                   |                         | Per<br>square.      | Per<br>linear<br>foot. | Per<br>square.         | Per<br>linear<br>foot. |
| Ashbrook Neck, Miss.       | \$107,309.30                                  | .....                             | \$40,039.87                       | \$67,269.43             | \$10.47             | \$49.86                | \$1.28                 | \$8.13                 |
| Panther Forest, Ark.       | 50,366.07                                     | .....                             | 11,956.72                         | 38,409.35               | 10.01               | .....                  | 1.60                   | .....                  |
| Greenville, Miss.          | 76,831.06                                     | \$15,725.94                       | .....                             | 92,557.00               | 15.25               | 40.56                  | 1.28                   | 12.87                  |
| Grand Lake, Ark.           | 39,603.78                                     | .....                             | 25,669.70                         | 13,934.08               | 11.23               | .....                  | 1.67                   | .....                  |
| Princeton, Miss.           | 75,974.67                                     | .....                             | 45,571.62                         | 30,403.05               | 9.75                | .....                  | 1.00                   | .....                  |
| Fidler, Miss.              | 121,692.26                                    | 12,488.41                         | .....                             | 120,128.67              | 9.61                | 24.55                  | 1.39                   | 3.59                   |
| Cottonwood, Miss.          | 138,509.65                                    | .....                             | 3,365.73                          | 135,143.92              | 9.57                | 50.87                  | .43                    | 7.32                   |
| Vicksburg Harbor,<br>Miss. | 43,920.15                                     | 16,176.30                         | .....                             | 60,096.45               | 8.29                | 23.22                  | .94                    | 3.26                   |
| Reid-Bedford, La.          | 55,057.81                                     | .....                             | 33,303.43                         | 21,743.38               | 18.29               | .....                  | 2.92                   | .....                  |
| Red Fork, Ark.             | 34,645.45                                     | 2,458.96                          | .....                             | 37,104.41               | 17.13               | 18.25                  | .78                    | 3.37                   |

| Location.               | Work<br>accomplished. |                              | Total cost<br>of work. | Gross<br>unit cost. <sup>1</sup> |                        | Remarks.                                                                   |
|-------------------------|-----------------------|------------------------------|------------------------|----------------------------------|------------------------|----------------------------------------------------------------------------|
|                         | Squares <sup>2</sup>  | Linear<br>feet. <sup>3</sup> |                        | Per<br>square.                   | Per<br>linear<br>foot. |                                                                            |
| Ashbrook Neck, Miss.    | 6,424                 | 1,100                        | \$75,491.15            | \$11.75                          | \$58.09                | Expended for repairs to existing works, \$17,402.38.                       |
| Panther Forest, Ark.    | 3,707                 | .....                        | 43,341.97              | 11.60                            | .....                  | Repairs for completing last year's extension, \$11,277.91.                 |
| Greenville, Miss.       | 6,068                 | 1,070                        | 100,361.53             | 16.53                            | 53.43                  | Expended for 1,904 squares of specially constructed pavement, \$43,380.13. |
| Grand Lake, Ark.        | 1,205                 | .....                        | 16,746.28              | 13.90                            | .....                  | Repairs to existing works.                                                 |
| Princeton, Miss.        | 3,129                 | .....                        | 33,422.21              | 10.75                            | .....                  | Work started; no pavement completed.                                       |
| Fidler, Miss.           | 12,141                | 4,750                        | 133,678.58             | 11.00                            | 28.14                  | Length reported is for complete repairs and renewals; no new extension.    |
| Cottonwood, Miss.       | 11,669                | 2,000                        | 116,383.81             | 10.00                            | 58.19                  | Work started; no pavement completed.                                       |
| Vicksburg Harbor, Miss. | 7,244                 | 2,500                        | 66,209.04              | 9.14                             | 23.22                  |                                                                            |
| Reid-Bedford, La.       | 1,155                 | .....                        | 25,194.21              | 21.81                            | .....                  |                                                                            |
| Red Fork, Ark.          | 5,269                 | 3,000                        | 41,174.55              | 7.91                             | 21.62                  |                                                                            |

<sup>1</sup> Includes every item of field and overhead charges.

<sup>2</sup> Square include both subaqueous and upper bank work.

<sup>3</sup> Length of effective revetment gained.

## II. LEVEES.

### (a) Upper Tensas levee district.

*Location.*—Extending from the division line between Lincoln and Jefferson Counties on the right bank of the Arkansas River down to and along the right bank of the Mississippi River, to a point opposite Warrenton, Miss., a distance of 289 miles.

*Original condition.*—By congressional act of September 25, 1850, all Government lands, subject to overflow in Arkansas and Louisiana, were donated to the State authorities to assist in building levees along this front. The first project adopted by the State authorities contemplated the construction of levees, with a crown width equal to their height, a base width equal to seven times their height, and a height such as to be 30 inches above the highest then known water.

With funds obtained from the sale of overflowed public lands donated to the States in 1850, a continuous line of levee was built from the Amos Bayou hills to the lower limits of the district. These levees were practically destroyed in the great flood of 1858, and but little levee work was undertaken between 1858 and 1882.

*Previous project.*—None.

*Existing project.*—The present project was adopted by the commission in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line, in cooperation with State and local levee boards, to a grade 3 feet above the deduced confined highwater of 1912, and a section having an 8-foot crown, a river slope of 3 to 1, a land slope of 3 to 1 from 8 feet below the crown, and thence a banquettes, 20 feet wide for levees 10 to 13 feet high, 30 feet wide for levees 13 to 16 feet high, and 40 feet wide for levees higher than 16 feet, with a crown slope of 10 to 1.

*Operations and results during the year.*—Work was continued until July 15, 1917 on the enlargement, to commission grade and section, of the Arkansas River levee from station 0-149, under oral agreement with John R. Scott at the rate of 14 cents per cubic yard. On account of the low price of work and greatly increased cost of all kinds of supplies and labor, Mr. Scott abandoned the work. During the year under the agreement 19,469 cubic yards were placed at a total cost of \$2,750.86.

Proposals were then invited on the remaining uncompleted work in this stretch, about 135,000 cubic yards, but all bids were deemed excessive. On November 21, 1917, an oral agreement was entered into with C. O. Chambliss for the construction of the said remaining enlargement at a unit price of 23.3 cents per cubic yard. Under this agreement 53,599 cubic yards have been placed at a total cost of \$12,488.57.

On July 16, 1917, a contract was awarded the Hercules Co. (Ltd.), for the construction of the enlargement, to commission grade and section, of the Arkansas River levee from stations 191 to 500, at the rate of 23.3 cents per cubic yard, the total being 1,265,000 cubic yards; this being the uncompleted portion of the work formerly under oral agreement with Reeve H. Hutchinson, at the rate of 12 cents per cubic yard, which he abandoned in March, 1917. During the year the Hercules Co. (Ltd.), placed 109,366 cubic yards of dirt at a total cost of \$25,493.93.

Work was continued on the enlargement, to commission grade and section, of the Arkansas River levee, stations 530+15 to 743, under contract with Roach & Stansell. During the year section 1, containing 346,929 cubic yards at a unit price of 17 cents amounting to \$58,977.93, was completed. On section 2, 55,781 cubic yards were placed at a total cost of \$11,714.01, unit price being 21 cents per cubic yard, completing the enlargement from stations 530+15 to 593.

The proposed enlargement to commission grade and section of the Arkansas River levee from stations 743 to 912 was twice during the year advertised for bids. The lowest bids received, first 48.7 cents per cubic yard, second 53.7 cents per cubic yard, were both rejected, being considered excessive. Plans were then approved to do this work by day labor with levee machines, and an order has been placed with the Bucyrus Co. for delivery by July 1, 1918, of a tower excavator and a small drag line excavator. Work of clearing right of way and the assembly of camp equipment has commenced and 1,000 tons of coal purchased and distributed on the works; the expenditures to date amounting to \$7,528.04.

Work was continued and contract completed with N. C. Williamson & Co., for the enlargement, to commission grade and section, of the levee in Louisiana from station 756 + 35 to 930 (530 R.) at the rate of 14.87 cents per cubic yard. During the year 29,885 cubic yards were placed at a total cost of \$4,443.90. The contract was completed September 12, 1917, the total yardage being 480,585 cubic yards at a total cost \$71,463.01, completing the enlargement from station 756 + 35 to 930.

On September 26, 1917, contract was entered into with Roach, Clerk & Co. for the construction of a new loop at Donna Vista, La., made necessary on account of active caving bank between stations 1099+22 and 1175+22 (535 R.). This work amounted to a total of 397,391 cubic yards at a total cost of \$139,086.85, the unit price being 35 cents per cubic yard. The levee was constructed to a grade  $2\frac{1}{2}$  feet above the 1916 high water, and a section of 3 to 1 slopes on both sides. Contract completed December 31, 1917.

Levee machine B-7 (Bucyrus drag line) was delivered, erected, and commenced the enlargement of the levee to commission grade and section, at station 1560 (542 R.) in Louisiana on December 23, 1917. Since the work was started, for the most part, weather and river conditions have been unfavorable, and to date 144,149 cubic yards have been placed at a field cost of operation of \$29,113.24, being 20.2 cents per cubic yard. The cost of machine and installation amounts to \$80,971.66. The machine working up the levee has completed the enlargement to station 1509.

Work was continued and contract completed with Clark, Harris & Dulaney for the construction to commission grade and section of the Hagaman, La., new levee stations 1559+81 to 1516+46, (542 R.), at the rate of 19 cents per cubic yard. During the year 371,558 cubic yards were placed at a total cost of \$70,596.11. The contract was completed April 24, 1918, the total yardage 530,155 cubic yards at a total cost of \$100,729.45.

The average price of contract work let during the year was 25.9 cents per cubic yard.

The accompanying profile plate No. 13 shows present grade of the levee line, the proposed commission grade, and the elevation of recent extreme floods.

Total expenditures in this district amounted to \$448,899.93.

*Conditions at end of the year.*—The total length of levee line in this district is 240.5 miles, of which 176.7 miles is along the Mississippi River and 33.8 miles along the Arkansas River, 193.8 miles of levee being built to a provisional grade of 2 feet above the highest flood; 16.1 miles have been completed to full commission grade and section. To complete the entire line to this project grade and section will require the placing of approximately 28,008,310 cubic yards, of which 19,270,438 cubic yards is required in the levee along the Mississippi River and 8,739,872 cubic yards in the levees along the Arkansas River.

The total expenditures in this district, including construction and maintenance, aggregate \$8,083,132.68. See statement following paragraphs under over Yazoo levee district showing conditions at end of the year and total levee yardage (p. 3665).

*Local cooperation.*—The expenditures by the local levee boards prior to and during the calendar year 1917 are shown in the following table:

| Name of levee board.                                                                        | From 1882 to Dec. 31, 1916. | During calendar year 1917. | Total to Dec. 31, 1917. |
|---------------------------------------------------------------------------------------------|-----------------------------|----------------------------|-------------------------|
| Southeast Arkansas levee district, Ark.....                                                 | \$1,143,545.82              | \$110,499.77               | \$1,254,045.59          |
| State of Louisiana, Tensas Basin levee district and fifth Louisiana levee district, La..... | 7,283,007.35                | 373,284.24                 | 7,656,291.24            |
| Total.....                                                                                  | 8,426,553.27                | 483,784.01                 | 8,910,336.83            |

In addition to the above, the terms of the flood control act (H. R. 14777, 4th Cong.) requiring local interests to contribute "not less than one-half of each sum as may have been allotted by the commission" have been complied with; special contributions covering all allotments by the commission have been made by levee boards as follows:

|                                        |             |
|----------------------------------------|-------------|
| Southeast Arkansas levee district..... | \$46,666.67 |
| Tensas Basin levee district.....       | 92,000.00   |
| Fifth Louisiana levee district.....    | 71,334.00   |

*Terminal facilities.*—Included in channel work. (See paragraph I (n) p. 3654.)

*Effect of improvement.*—An area of 2,500 square miles has been completely protected from overflow, and 500 square miles additional are protected from all ordinary floods.

*Proposed operations.*—Completion of all work under contract, and continuation of levee construction and enlargement to commission grade and section in accordance with existing projects and in compliance with provisions of the flood control act.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

#### (b) Lower Yazoo levee district.

*Location.*—Left bank of river from the Coahoma-Bolivar County line, 365 miles below Cairo to mouth of the Yazoo River diversion canal, 599 miles below Cairo.

*Original condition.*—Prior to 1882 the local levee board had constructed a continuous line of levee along this front from the upper end to Eagle Lake, 24 miles above the mouth of the Yazoo River. The extreme flood of 1882 destroyed many miles of this line.

*Existing project.*—The same as specified for the upper Tensas levee district. (See II (a).)

*Operations and results during the present year.*—Work on the enlargement of the levee from station 0 to station 520 was continued by day labor with the Government levee machine C-1. On account of the long haul and unfavorable pit conditions, progress was slow. During the year 45,755 cubic yards were placed at a field cost of \$19,102.25 (41.8 cents per cubic yard), which completed the levee to commission grade and section, to station 143.

Project for enlargement to commission grade and section of the levee from stations 500 to 900 (374-380 L.) by day labor with levee machines was approved. A tower excavator and a small drag-line excavator have been ordered from the Bucyrus Co. to be delivered by August 1, 1918; and camp equipment is being assembled, the expenditure to date being \$1,494.40.

On September 26, 1917, contract was awarded George F. Ramsey for the construction of the enlargement, to commission grade and section, of the levee along the Rosedale, Miss., front, stations 1200 to 1513 (395 L.); the contract amounting to 500,000 cubic yards at a unit cost of 32.9 cents per cubic yard, to be completed December 31, 1918. To date the contractor has placed 203,456 cubic yards, at a total cost of \$66,937.02, completing 73,000 feet of the enlargement.

On December 10, 1917, contract was awarded the firm of Roach, Stansell, Lowrance Bros. & Co., for the construction of the enlargement, to commission grade and section, of Riverton Levee, stations 1513 to 1575+46 (398 L.); the contract amounting to 160,000 cubic yards at a unit cost of 32.8 cents per cubic yard, to be completed December 31, 1918. No work except drainage has been done on account of unfavorable river conditions.

Work was continued and contract completed with Walter H. Denison for the enlargement to commission grade and section of the levee from station 1850 to 2050 (402 L.), at 14.37 cents per cubic yard. During the year 66,557 cubic yards were placed at a cost of \$9,564.24. The contract was completed March 12, 1918; the total yardage being 748,615 cubic yards at a total cost of \$107,575.99, completing the enlargement from stations 1850 to 2050.

Between stations 1850+50 and 1855 (402 L.), across Willow Slough, a slide occurred on the river side of the levee. To remedy this a riverside blanket was built by day labor, a total amount of 14,746 cubic yards of dirt being placed at a total cost of \$8,555.

No work was done on the enlargement of the Lake Beulah Crevasse Levee, stations 2050-2130 (404 L.), under contract with R. T. Clark & Co. On account of the scarcity of forces the above firm was permitted to contract for a portion of an emergency loop in Louisiana, after completion of which conditions were so that they could not operate on the Beulah contract.

In October, 1917, work was commenced by day labor, grading for the city landing at Greenville, Miss., and enlarging to commission grade and section, the levee stations 4251+50 to 4265+45 (478 L.). This work was completed in February, 1918, there having been placed 34,686 cubic yards of material at a total cost of \$24,053.05.

Work was continued until September 30, 1917, on the enlargement of the levee, stations 1167-1567+33 (495-502 L.) below Greenville, under contract with Bondurant, Callahan, Cheshire & Co. During that period 52,099 cubic yards were placed at a total cost of \$7,471. The unit price of work under this contract was 14.34 cents per cubic yard. After September 30, 1917, on account of financial differences between the subcontractor owning the levee machine and the contractor, the work was abandoned, leaving about 600 feet of levee just ahead of the completed work cut down to banquetta grade, after repeated efforts to induce the contractors to resume work. A force account agreement was arranged with H. B. Blanks, who had purchased the cableway excavator to resume the operation of the machine and complete the levee along the reach cut down, at a unit cost of 30 cents per cubic yard. Twenty-two thousand four hundred and thirty-two cubic yards were placed under this agreement, completing the enlargement along the low levee at a total cost of \$6,729.60. This contract was annulled May 2, 1918, and the yardage remaining to be placed, amounting to 460,000 cubic yards, was readvertised; bids opened May 20, 1918; and work relet to H. B. Blanks at a unit cost of 39.5 cents per cubic yard.

On November 30, 1917, contract was awarded H. B. Blanks for the enlargement to commission grade and section of the Worthington Point Levee, stations 1700 to 1800 (509 L.), below Greenville; the contract amounting to 250,000

cubic yards, at a unit cost of 29 cents per cubic yard, to be completed December 31, 1918. To date the contractor has placed 132,138 cubic yards at a cost of \$38,320.02, completing the enlargement between stations 1760 and 1800.

Work was continued and contract completed by the H. B. Blanks Levee Co. or the enlargement, to commission grade and section of the levee from station 800 to 2100 (509-514 L.), below Greenville, at 12.24 cents per cubic yard. During the year 144,571 cubic yards were placed at a total cost of \$17,695.49. The contract was completed March 23, 1918, the total yardage being 732,918 cubic yards at a total cost of \$89,709.17, completing the enlargement from station 800 to 2100.

On October 2, 1917, contract was entered into with the firm of W. T. & E. M. Lowrance & Co. for enlarging to a grade of 2 feet above the 1916 high water certain stretches of levee of deficient height and section, near the lower end of his district. Below is a table showing the location, amount, cost, and per cent completed of this work.

| Name of levee.        | R. D.              | Section. | Stations.         | Total yardage. | Cubic yards in place. | Unit price.   | Total cost. |
|-----------------------|--------------------|----------|-------------------|----------------|-----------------------|---------------|-------------|
|                       |                    |          |                   |                |                       | <i>Cents.</i> |             |
| Lesley and Shipland.. | { 542 L.<br>542 L. | 1        | 3302-3355.....    | 46,244         | <sup>1</sup> 46,244   | 28            | \$12,948.32 |
|                       |                    |          | 3450-3491.....    | 27,875         | <sup>1</sup> 27,875   | 28            | 7,806.40    |
| Alula.....            | 550 L.             | 1        | 3700-3817.....    | 87,867         | <sup>1</sup> 87,867   | 28            | 24,602.76   |
|                       |                    | 2        | 3817-3910.....    | 89,209         | <sup>1</sup> 89,207   | 45            | 40,143.15   |
|                       |                    | 1        | 4418+55-4577+20.. | 114,765        | <sup>1</sup> 114,765  | 28            | 32,134.20   |
| Tennessee.....        | 562 L.             | 2        | 4577+20-4614+71.. | 129,979        | 93,130                | 26            | 24,213.80   |
|                       |                    | 3        | 4614+71-4732+33.. | 94,207         | <sup>1</sup> 94,207   | 25            | 23,551.75   |

<sup>1</sup> Contract completed.

The average price of contract work during the present year was 0.318 cent per cubic yard.

The total expenditures in this district during the year amounted to \$71,064.50.

*Condition at the end of the year.*—The length of the levee line is 185.2 miles, 14.2 miles have been built to a provisional grade of 2 feet above the highest flood, and 21 miles have been completed to full commission grade and section. To bring the entire line up to this grade and section will require approximately 1,099,462 cubic yards. The accompanying profile Plate No. 14 shows the present grade of the levee line, the proposed commission grade, and the elevations of recent extreme floods.

The total expenditures in this district, including construction and maintenance, aggregate \$7,108,428.33.

See table below giving total levee yardage:

*Data concerning levee yardage in the third Mississippi River district.*

| Levee district.   | In system.         | Built.        | Contents, 1917.     | Built since by—        |                      | Total built since 1917. |
|-------------------|--------------------|---------------|---------------------|------------------------|----------------------|-------------------------|
|                   |                    |               |                     | United States.         | Local authorities.   |                         |
|                   | <i>Miles.</i>      | <i>Miles.</i> | <i>Cubic yards.</i> | <i>Cubic yards.</i>    | <i>Cubic yards.</i>  | <i>Cubic yards.</i>     |
| Lower Yazoo.....  | 206.3              | 185.2         | 53,271,514          | <sup>1</sup> 1,269,742 | <sup>2</sup> 584,059 | 1,853,801               |
| Upper Tensas..... | <sup>2</sup> 241.0 | 191.3         | 54,062,474          | 1,387,144              | 772,235              | 2,159,379               |

| Levee district.   | Lost or abandoned during year. | Contents, 1918.     | Required to complete. | Estimated final contents. | Per cent now built. | Approximate area protected. |
|-------------------|--------------------------------|---------------------|-----------------------|---------------------------|---------------------|-----------------------------|
|                   |                                |                     |                       |                           |                     | <i>Square miles.</i>        |
|                   | <i>Cubic yards.</i>            | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cubic yards.</i>       |                     |                             |
| Lower Yazoo.....  | 180,000                        | 54,945,315          | 32,099,462            | 87,044,777                | 63.1                | 3,367                       |
| Upper Tensas..... | <sup>2</sup> 865,000           | 55,356,853          | 28,008,310            | 83,365,163                | 66.4                | 2,676                       |

<sup>1</sup> 53,276 cubic yards, Ashbrook Dike not included.

<sup>2</sup> 3,315 cubic yards in sublevees not included.

<sup>3</sup> Includes the extension of the district to the Lincoln-Jefferson County line on Arkansas River.

*Cost of levees in third district built by machines.*

| Machine and location.                                                | Mobilization. | Clearing. | Drainage. | Plowing. | Operation. | Repairs.   | Dressing. |
|----------------------------------------------------------------------|---------------|-----------|-----------|----------|------------|------------|-----------|
| Levee machine C-1; lower Yazoo levee district.....                   | \$2,750.00    | \$699.71  | \$553.84  | \$85.58  | \$3,570.37 | \$1,081.37 | \$338.00  |
| Levee machines B-4 and B-5; Ashbrook Dike.....                       | 3,290.00      | 27,658.99 | 358.06    | 13.69    | 37,431.32  | 4,443.51   | 2,721.00  |
| Levee machine B-7; upper Tensas levee district in Louisiana.....     | 1,930.00      | 906.89    | 1,062.54  | 83.30    | 12,686.06  | 3,227.05   | 1,605.00  |
| Levee machine C-2; upper Tensas levee district (Arkansas River)..... | 319.52        | 1,341.40  | .....     | .....    | 5,867.12   | .....      | .....     |
| Levee machine C-3; lower Yazoo levee district.....                   | 1,494.40      | .....     | .....     | .....    | .....      | .....      | .....     |

| Machine and location.                                                | Sodding. | Care.      | Depreciation. <sup>1</sup> | Overhead.  | Total cost.           | Handled.      | Cost per yard. |
|----------------------------------------------------------------------|----------|------------|----------------------------|------------|-----------------------|---------------|----------------|
| Levee machine C-1; lower Yazoo levee district.....                   | \$181.82 | \$5,280.96 | \$4,560.00                 | \$3,000.40 | \$22,102.65           | Yards, 45,755 | Cent, 48       |
| Levee machines B-4 and B-5; Ashbrook Dike.....                       | 60.47    | 4,805.64   | 16,517.20                  | 8,682.66   | 107,338.02            | 537,276       | 19             |
| Levee machine B-7; upper Tensas levee district in Louisiana.....     | 445.44   | 4,827.93   | 8,097.17                   | 3,137.11   | 38,008.72             | 144,149       | 26             |
| Levee machine C-2; upper Tensas levee district (Arkansas River)..... | .....    | .....      | .....                      | .....      | <sup>2</sup> 7,528.04 | .....         | .....          |
| Levee machine C-3; lower Yazoo levee district.....                   | .....    | .....      | .....                      | .....      | <sup>2</sup> 1,494.40 | .....         | .....          |

<sup>1</sup> Depreciation of plant is fixed at 20 per cent per annum.<sup>2</sup> Machines not delivered. Work shown is assembling of camp equipment, purchase and distribution of material and supplies.

**Local cooperation.**—The expenditures by the only local levee board interested in the maintenance of this levee line are shown by the following statement:

Name: Board of Mississippi Levee Commissioners.

Expended from 1882 to Dec. 31, 1916.....\$15,242,761.

Expended during calendar year 1917.....446,297.

Total to Dec. 31, 1917.....15,689,058.

In addition to the above, the terms of the flood-control act (H. R. 1477, 64th Cong.) requiring local interests to contribute "not less than one-half such sum as may have been allotted by the commission," have been complied with; the Board of Mississippi Levee Commissioners making special contributions to apply as above amounting to \$270,001.

**Terminal facilities.**—Included in channel works. (See paragraphs I (c) and I (o).)

**Effect of the improvement.**—An area of 3,367 square miles has been protected from overflow.

**Proposed operations.**—Completion of all work under contract, and continuation of levee construction and enlargement to commission grade and section in accordance with existing projects and in compliance with provisions of the flood-control act.

**Recommended modifications of project.**—None.

**References to published articles not previously reported.**—None.

## III. SURVEYS.

(a) *Revetment surveys.*

Hydrographic surveys were made over all revetments, between July 12 and September 11, 1917. The information obtained from these surveys is incorporated in the several paragraphs relating to condition of revetments.

In these surveys the original base lines, run out in order to accurately locate the mats placed, and certain fixed ranges, usually 200 feet apart, were retraced; soundings were taken on the ranges thus located; shore lines were run above and below the revetments as far as active caving was encountered, and soundings were taken on ranges 1,000 to 1,500 feet apart within these reaches.

*(b) Reach and bank line surveys.*

Surveys were also made in the following reaches: Dennis (372 L.); Waxhaw (393 L.); Riverton (400 L.); Caulks Neck (409 R.); Niblets, Miss. (410 L.); Chicot, Ark. (430 R.); Arkansas City (439 R.); Millers Bend (459 L.); Lake Jackson (511 L.); Valewood, Miss. (528 L.); Stack Island Chute (540 L.); Donna Vista, La. (534 R.); Cottonwood (558 L.); Brunswick (573 L.); Henderson (573 R.); Millikens Bend (583 R.), and Duckport, La. (590 R.).

These surveys indicate that caving is in progress in all reaches surveyed, and that new levee loops or revetments will be necessary in the immediate or near future at the following points:

Riverton, Miss. (400 L.).  
 Valewood, Miss. (528 L.).  
 Brunswick, Miss. (574 L.).  
 Henderson, La. (573 R.).  
 Millikens Bend, La. (583 R., 585 R.).

In these surveys the bank line was meandered, and where necessary soundings were taken on ranges 1,000 to 1,500 feet apart, and preliminary lines run for proposed new levees.

The field cost of these surveys amounted to \$3,624.20.

In addition to the above surveys a special survey was made by direction of the Mississippi River Commission to investigate all gravel deposits in the district. The following points were investigated:

Sibley Chute (391 R.)  
 Catfish Towhead (421 L.)  
 Island No. 78 (435 R.)  
 Island No. 81 (444 R.)  
 Island No. 82 (451 R.)  
 Greenville, Miss. (478 L.)

A report was made to the commission March 7, 1918 giving results of survey in full.

## IV. PLANT.

The following items of plant were added during the year:

The steam tug *Parker* previously condemned was rebuilt new. Work on 12 new creosoted barges was completed and six additional creosoted barges authorized and work on same commenced. Steam concrete mat-laying boat No. 1713, concrete tower barge No. 1712, and concrete mixing plants Nos. 1709 and 1711 were built; and work completed on grader No. 1014, and the new machine shop; all of the above work being performed by hired labor at the repair fleet and boat yard at Vicksburg, Miss.

The following table shows the cost of new plant built or purchased during the year, June 1, 1917 to May 31, 1918:

| Name or number.                      | Cost.             | How obtained.                                                                                 |
|--------------------------------------|-------------------|-----------------------------------------------------------------------------------------------|
| Tug Parker.....                      | \$11,577.14       | Built by hired labor at United States boat yard.                                              |
| Launch Portia.....                   | 3,166.93          | Purchased from private parties; minor repairs made by hired labor at United States boat yard. |
| 2 new barges.....                    | 9,207.68          | Built by hired labor at United States boat yard. Completed.                                   |
| 1 new barges.....                    | 26,532.21         | Built by hired labor at United States boat yard. Not completed.                               |
| Sand and gravel dredge No. 1312..... | 8,243.29          | Purchased from private parties and overhauled by hired labor at United States boat yard.      |
| Mat boat No. 1713.....               | 29,279.02         | Built by hired labor at United States boat yard.                                              |
| Grader No. 1014.....                 | 2,648.39          | Built by hired labor at United States boat yard. Completed.                                   |
| New machine shop.....                | 3,515.94          | Do.                                                                                           |
| Power barge 1712.....                | 11,224.01         | Built by hired labor at United States boat yard.                                              |
| Line barge 1714.....                 | 1,154.84          | Do.                                                                                           |
| Concrete mixer 1709.....             | 1,081.52          | Do.                                                                                           |
| Concrete mixer 1711.....             | 4,859.95          | Do.                                                                                           |
| Calking flat No. 7.....              | 128.52            | Do.                                                                                           |
| Calking flat No. 8.....              | 128.80            | Do.                                                                                           |
| Auto truck.....                      | 794.89            | Purchased from Powell Motor Co., tools, etc., made by hired labor at United States boat yard. |
| Knives (20).....                     | 924.43            | Built by hired labor at United States boat yard.                                              |
| <b>Total.....</b>                    | <b>114,487.56</b> |                                                                                               |

General repairs were made to plant during the year, and plant was care for during the lay-up season.

The following table shows the cost of repair work done on plant during the year, June 1, 1917, to May 31, 1918:

| Name or number.                             | Cost.             | Work done.                                                                                                                                                                           |
|---------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Steamers:</b>                            |                   |                                                                                                                                                                                      |
| Control.....                                | \$2, 213. 75      | Docking, repairing hull, new cylinder timber, calking, building lockers, work on wheel, cabin general repairs to machinery, work on windows, guards, deck, cams, pipes, and boilers. |
| H. St. L. Coppee.....                       | 2, 103. 04        | Repairing valves, machinery, boilers, work on windows, doors, rudder, painting, making flanges, etc. Docked and repaired hull.                                                       |
| Arthur Hider.....                           | 1, 806. 44        | Work on pipes, fenders, repairing lubricators; installing new boilers.                                                                                                               |
| Issaquena.....                              | 2, 302. 52        | Building screen doors, repairing main chains, doctor, work on exhaust pipe, machinery, painting, etc. Decking.                                                                       |
| <b>Tugs:</b>                                |                   |                                                                                                                                                                                      |
| White Water.....                            | 1, 143. 20        | Docking, putting sleeve on plunger, repairing pump, making new hatch covers, work on valves, windows, doors, overhauling machinery, etc.                                             |
| Boaz.....                                   | 578. 19           | Repairing nosing, work on deck, crank pin, ash buckets, testing boilers, work on cabin, etc.                                                                                         |
| Sydney C.....                               | 974. 61           | Making britchen, repairs to pipe, boilers, heater pumps, and engine.                                                                                                                 |
| <b>Launches:</b>                            |                   |                                                                                                                                                                                      |
| Carroll.....                                | 85. 77            | Repairing rudder, shaft, making bearings, etc.                                                                                                                                       |
| Chicot.....                                 | 581. 36           | Docking, welding shaft, fitting up cylinders, repairs to hull, engine, generator, etc.                                                                                               |
| <b>Gas boats:</b>                           |                   |                                                                                                                                                                                      |
| No. 2.....                                  | 22. 59            | General repairs (minor).                                                                                                                                                             |
| No. 3.....                                  | 30. 98            | Repairs to engine, etc.                                                                                                                                                              |
| <b>Graders:</b>                             |                   |                                                                                                                                                                                      |
| No. 1011.....                               | 221. 58           | Grinding valves, work on lubricator, pipes, overhauling screens, making stands, etc.                                                                                                 |
| No. 1012.....                               | 776. 45           | Making bolts, threading pipes, work on doors, clamps, bushings, repairs to main pump, grinding valves, building lockers, work on condenser, ash chute, capstan, injector, etc.       |
| No. 1013.....                               | 280. 09           | Making nozzle tips, work on cabin, pumps, boilers, screen doors, etc.                                                                                                                |
| <b>Derricks:</b>                            |                   |                                                                                                                                                                                      |
| No. 1711.....                               | 943. 20           | Building roof, calking, piping, making patterns, work on machinery, repairs to furnace, etc.                                                                                         |
| No. 071.....                                | 171. 80           | Repairing boom, making patterns, overhauling doors, windows, cabin, etc.                                                                                                             |
| No. 1109.....                               | 904. 32           | Putting in timber heads, repairing cabin, work on deck, and boom, repairs to engine, brake bands, etc.                                                                               |
| No. 1311.....                               | 371. 09           | Calking sides, repairing deck, docking, testing boilers, etc.                                                                                                                        |
| No. 1503.....                               | 426. 25           | Repairing boom, sheaves, making bushings, pins, repairing engine, etc.                                                                                                               |
| No. 1504.....                               | 454. 13           | Repairing derrick boom, work on pump, deck, sheaves, boilers, brake bands, calking, etc.                                                                                             |
| No. 1509.....                               | 171. 34           | Making patterns, testing boilers, repairing engine, work on capstan, siphon, etc.                                                                                                    |
| <b>Concrete mixing plant, No. 1511.....</b> | <b>1, 301. 43</b> | <b>Transferring machinery from concrete mixing plant No. 072; enlarging cement bins, etc.</b>                                                                                        |
| <b>Quarter boats:</b>                       |                   |                                                                                                                                                                                      |
| No. 31.....                                 | 78. 90            | Repairing screens, ice boxes, windows, handling lumber, painting, etc.                                                                                                               |
| No. 155.....                                | 128. 37           | Docking, calking, spiking, putting plank in rake, painting, etc.                                                                                                                     |
| No. 156.....                                | 115. 64           | Calking sides, building stage plank, work on cabin, etc.                                                                                                                             |
| No. 157.....                                | 43. 65            | Handling lumber, etc.                                                                                                                                                                |
| No. 159.....                                | 480. 18           | Repairing pipes, screen doors, cabin, painting, etc.                                                                                                                                 |
| No. 1010.....                               | 47. 66            | Repairs to stovepipe, work on ice boxes, etc.                                                                                                                                        |
| No. 1108.....                               | 128. 35           | Handling material and work on fenders.                                                                                                                                               |
| No. 1202.....                               | 29. 62            | Making stovepipes, etc.                                                                                                                                                              |
| No. 1307.....                               | 518. 59           | Work on doors, deck, repairing roof, pipes, boilers, ice boxes, etc.                                                                                                                 |
| No. 1513.....                               | 51. 97            | Repairing cabin, installing electric plant, etc.                                                                                                                                     |
| No. 1308.....                               | 148. 65           | Building screen doors, repairing windows, roof, cabin, making desk, etc.                                                                                                             |
| No. 1607.....                               | 15. 62            | Repairing screens, etc.                                                                                                                                                              |
| <b>Mat boat: No. 1608.....</b>              | <b>2, 747. 92</b> | <b>Repairing angles, skids, capstan, engine, calking sides, building track, repairing pumps, work on brake bands, etc.</b>                                                           |

| Name or number.                | Cost.            | Work done.                                                                                      |
|--------------------------------|------------------|-------------------------------------------------------------------------------------------------|
| <b>Barges:</b>                 |                  |                                                                                                 |
| No. 073.....                   | \$314.68         | Repairing deck, putting in timber heads, calking, bolting, etc.                                 |
| No. 074.....                   | 120.50           | Work on timber heads, rake, calking, painting, etc.                                             |
| No. 086 (supply).....          | 844.71           | Calking sides, rakes, repairing deck, building supply house.                                    |
| No. 103.....                   | 2,447.03         | Docking work on rake, building platform, painting, building stage, etc. Made into tipple barge. |
| No. 104.....                   | 64.36            | Calking.                                                                                        |
| No. 572.....                   | 120.14           | Docking, repairing, calking, putting plank in bottom, etc.                                      |
| No. 579.....                   | 27.80            | Repairing, calking, etc.                                                                        |
| No. 580.....                   | 317.14           | Docking, calking, painting seams, etc.                                                          |
| No. 582.....                   | 213.58           | Putting in timber heads, docking, calking, bolting, etc.                                        |
| No. 585.....                   | 101.18           | Docking, planking sides, calking, painting seams, etc.                                          |
| No. 587.....                   | 3.25             | Putting in timber heads.                                                                        |
| No. 1106.....                  | 170.84           | Docking, calking, planking, etc.                                                                |
| No. 1102.....                  | 65.60            | Patching deck, calking sides, etc.                                                              |
| No. 1103.....                  | 117.70           | Calking, spinning oakum, work on bottom, etc.                                                   |
| No. 1203 (steel).....          | 125.31           | Building sides on barge.                                                                        |
| No. 1205 (steel).....          | 222.71           | Putting up sides and painting.                                                                  |
| No. 1304.....                  | 68.80            | Docking, handling material, painting, etc.                                                      |
| No. 1405.....                  | 214.02           | Docking, spinning oakum, calking bottom and sides, etc.                                         |
| No. 1509 (tower).....          | 315.02           | Overhauling, work on pipe, etc.                                                                 |
| No. 1601.....                  | 85.37            | Docking, painting, scraping hull, etc.                                                          |
| No. 1512.....                  | 19.01            | Repairing floor, calking, etc.                                                                  |
| No. 1206 (gravel).....         | 131.51           | Repairing bins, painting hull, etc.                                                             |
| No. 1606.....                  | 82.25            | Scraping, painting, etc.                                                                        |
| No. 1105.....                  | 91.22            | Docking, calking sides, etc.                                                                    |
| No. 1102.....                  | 213.65           | Docking, overhauling, calking, etc.                                                             |
| No. 1605 (steel).....          | 42.70            | Painting, etc.                                                                                  |
| No. 1302 (steel).....          | 75.30            | Painting and scraping.                                                                          |
| No. 1208.....                  | 61.50            | Docking, painting hull, taking off dock, etc.                                                   |
| old machine shop, No. 222..... | 177.64           | Repairing machinery, etc.                                                                       |
| repairing wagons.....          | 403.40           | Making U bolts, plates, and general overhauling.                                                |
| dry dock, No. 1015.....        | 871.73           | Putting down new sills, grinding valves, and work on pipes.                                     |
| <b>Total.....</b>              | <b>30,528.90</b> |                                                                                                 |

*Summary of plant expenditures.*

|                       |                   |
|-----------------------|-------------------|
| new plant.....        | \$114,467.56      |
| repairs to plant..... | 30,528.90         |
| ere of plant.....     | 14,847.63         |
| <b>Total.....</b>     | <b>159,844.09</b> |

The following inclosures accompany this report to which reference has been made:

- Plate No. 1. District map.
- Plate No. 2. Red Fork revetment.
- Plate No. 3. Ashbrook Neck revetment.
- Plate No. 4. Panther Forest revetment.
- Plate No. 5. Greenville revetment.
- Plate No. 6. Grand Lake revetment.
- Plate No. 7. Princeton revetment.
- Plate No. 8. Fitlers revetment.
- Plate No. 9. Cottonwood revetment.
- Plate No. 10. Vicksburg revetment.
- Plate No. 11. Reid-Bedford revetment.
- Plate No. 12. Lower Yazoo levees.
- Plate No. 13. Upper Tensas levees.

A. M. Todd,  
Assistant Engineer in Charge.

## ABSTRACT OF CONTRACTS IN FORCE, THIRD MISSISSIPPI RIVER DISTRICT, FOR FISCAL YEAR ENDED JUNE 30, 1918.

*Levee work in upper Tensas levee district.*

## ABOVE GREENVILLE, MISS.

Name of contractor: Geo. F. Ramsey.

Amount and character of work: Enlarging levee on Rosedale front to Mississippi River Commission grade and section, stations 1200 to 1513 (395 L.), involving about 500,000 cubic yards of earthwork embankment.

Unit price: 32.9 cents per cubic yard.

Date of contract: September 26, 1917.

Date of approval: October 2, 1917.

Date work begun: October 16, 1917.

Time limit: December 31, 1918.

Completed: Section 1: 1200-1396, 45 per cent; section 2: 1396-1513, 46 per cent.

Name of contractor: Roach, Stansell, Lowrance Bros. & Co.

Amount and character of work: Enlarging Riverton levee to Mississippi River Commission grade and section, stations 1513 to 1575+46 (398 L.), involving about 160,000 cubic yards of earthwork embankment.

Unit price: 32.8 cents per cubic yard.

Date of contract: December 10, 1917.

Date of approval: December 22, 1917.

Date work begun: January 10, 1918.

Time limit: December 31, 1918.

No work possible on account pits flooded.

Name of contractor: R. T. Clark & Co.

Amount and character of work: Enlarging Beulah Crevasse Levee to Mississippi River Commission grade and section, stations 2090 to 2130 (404 L.), involving about 319,116 cubic yards of earthwork embankment.

Unit price: 21.8 cents per cubic yard.

Date of contract: November 13, 1914.

Date of approval: November 27, 1914.

Date work begun: December 17, 1914.

Time limit: December 1, 1916. (Time limit waived Nov. 2, 1915, E. D. 95947/16.)

Completed: 73 per cent.

## BELOW GREENVILLE, MISS.

Name of contractor: H. B. Blanks.

Amount and character of work: Enlarging levees from Wayside to Stella, Miss., to Mississippi River Commission grade and section, stations 1167 to 1567+33 (495-502 L.), involving about 460,000 cubic yards of earthwork embankment.

Unit price: 39.5 cents per cubic yard.

Date of contract: June 1, 1918.

Date of approval: June 6, 1918.

Date work begun: June 21, 1918.

Time limit: December 31, 1918.

Preliminary work only—no dirt moved.

Name of contractor: H. B. Blanks.

Amount and character of work: Enlarging Worthington Point Levee to Mississippi River Commission grade and section, stations 1700 to 1800 (505 L.), involving about 250,000 cubic yards of earthwork embankment.

Unit price: 29 cents per cubic yard.

Date of contract: November 30, 1917.

Date of approval: December 5, 1917.

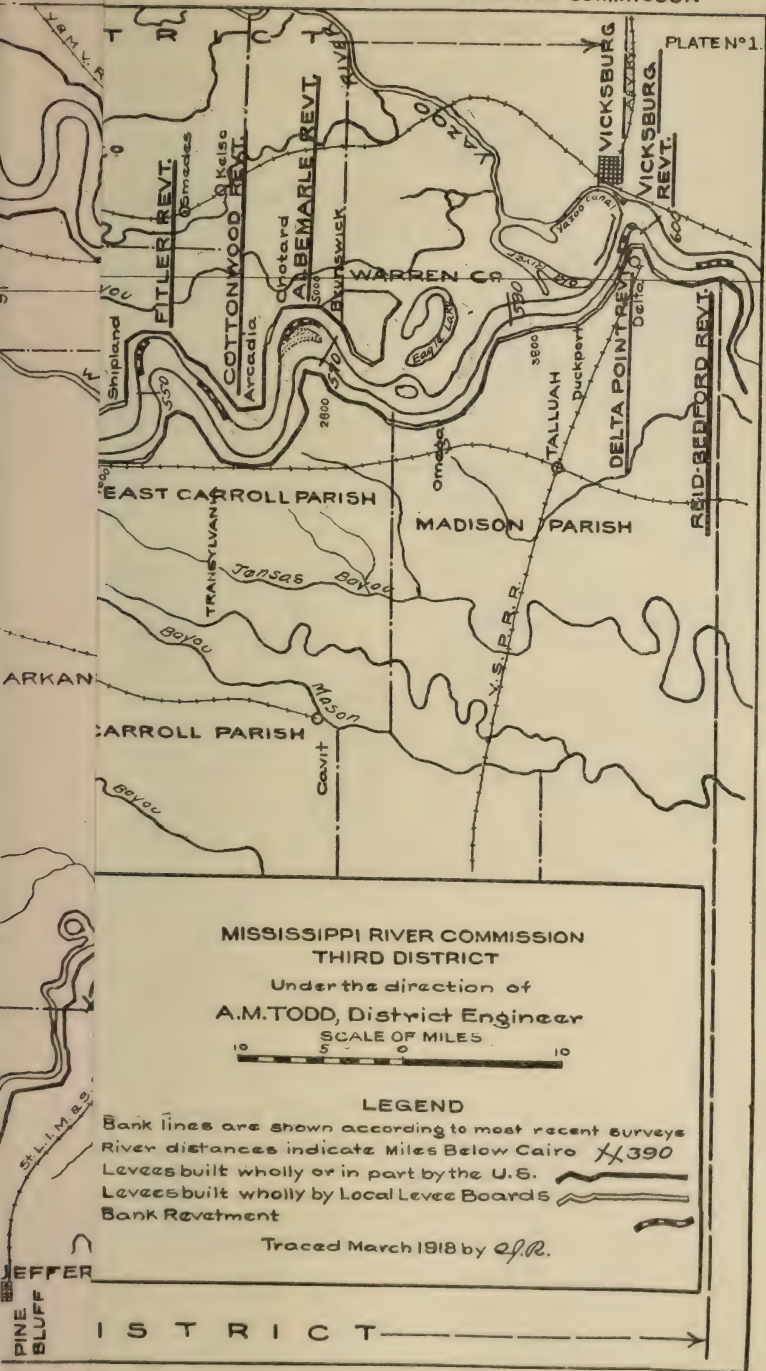
Date work begun: December 23, 1917.

Time limit: December 31, 1917.

Completed: 80 per cent.

WAR

# MISSISSIPPI RIVER COMMISSION



## MISSISSIPPI RIVER COMMISSION THIRD DISTRICT

Under the direction of  
A.M. TODD, District Engineer

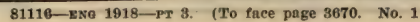
SCALE OF MILES  
0 5 10

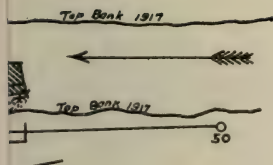
### LEGEND

- Bank lines are shown according to most recent surveys
- River distances indicate Miles Below Cairo
- Levees built wholly or in part by the U.S.
- Levees built wholly by Local Levee Boards
- Bank Revetment

Traced March 1918 by *Q.P.R.*

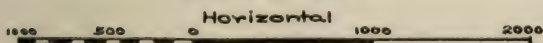
DISTRICT



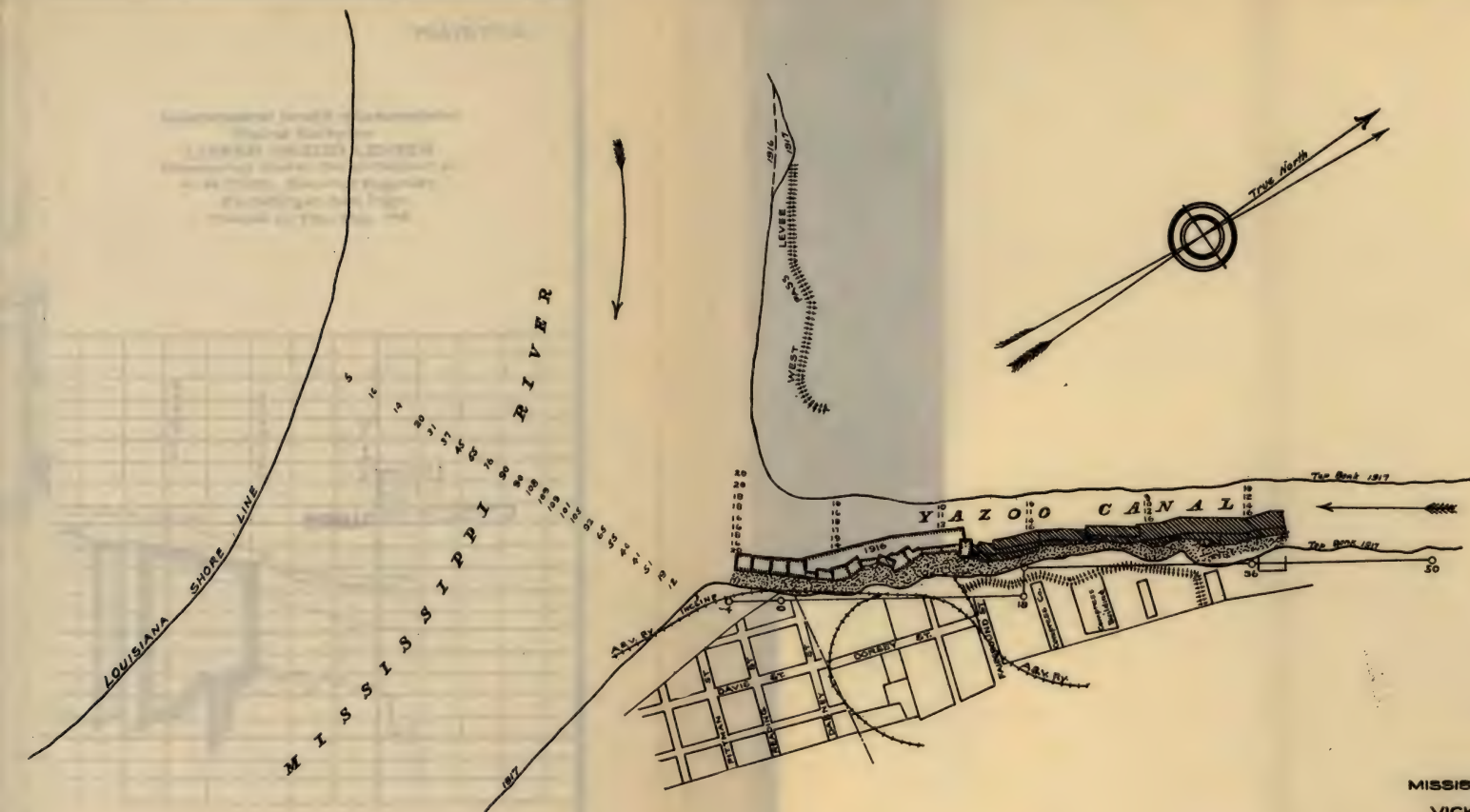


MISSISSIPPI RIVER COMMISSION  
Third District  
VICKSBURG REVETMENT  
MOUTH OF YAZOO CANAL

Prepared under the direction of  
A.M. TODD District Engineer  
SCALE OF FEET



Soundings reduced to 3' on Vicksburg Gage  
Survey of Sept 1917 *Q.R.* Chief of Party  
Traced May 1918 by *Q.R.*



|           |                                                 |
|-----------|-------------------------------------------------|
| Indicates | Concrete Mats built and sunk during Fiscal Year |
| "         | Concrete Mats.                                  |
| "         | Brush Bank Revetment                            |
| "         | Concrete Bank Raving.                           |

Vicksburg Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1918

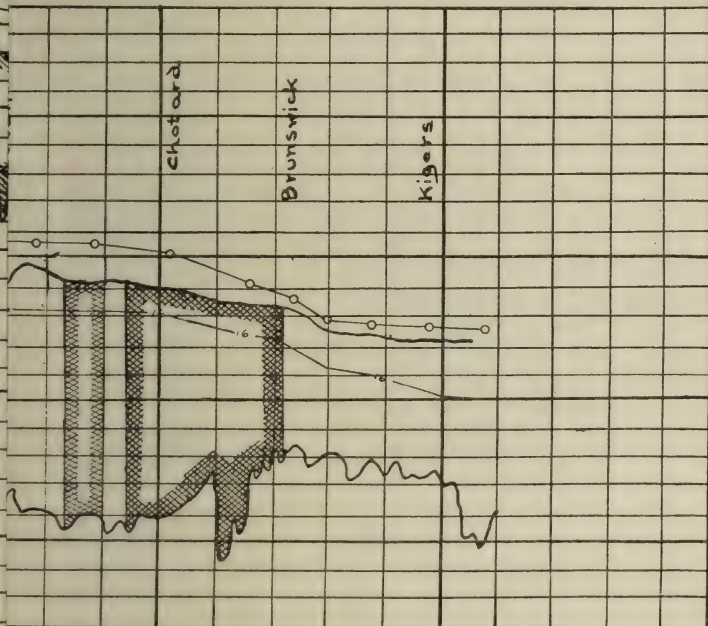
*Wm. Todd*  
Assistant Engineer in Charge

MISSISSIPPI RIVER COMMISSION  
Third District  
VICKSBURG REVETMENT  
MOUTH OF YAZOO CANAL  
Prepared under the direction of  
A.M.TODD District Engineer  
SCALE OF FEET

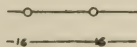
Horizontal

Soundings reduced to 3' on Vicksburg Gage  
Survey of Sept 1917 *J.H.* Chief of Party  
Traced May 1918 by *J.H.*

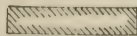
MISSISSIPPI RIVER COMMISSION  
 Third District  
**LOWER YAZOO LEVEES**  
 Prepared under the direction of  
 A.M. TODD District Engineer  
 E.C. Tollinger Asst. Engr.  
 Traced by T.B.L. May 1918



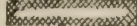
1914 Commission Grade  
 level of 1916.



Improved by United States 1917-1918

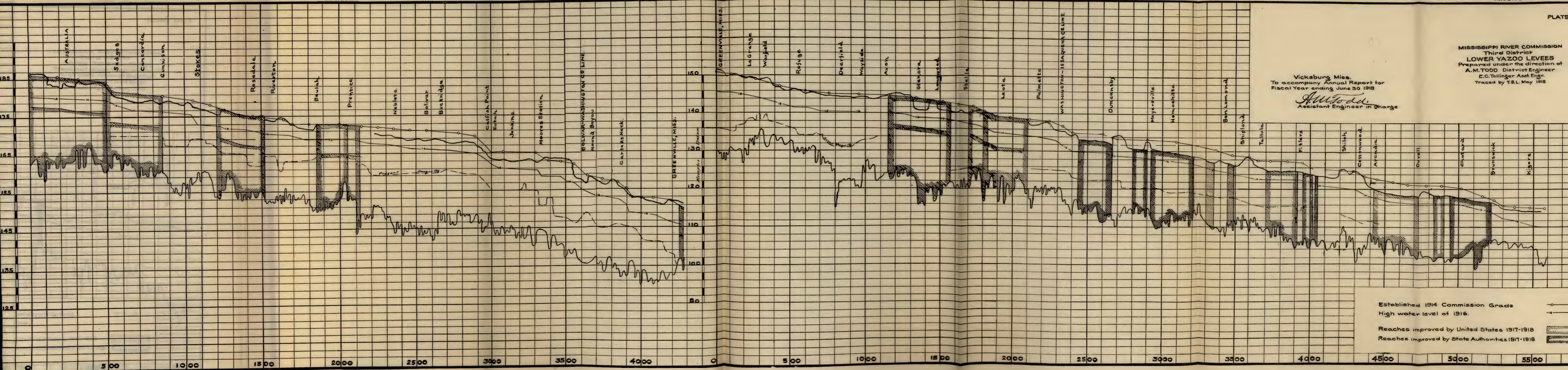


Improved by State Authorities 1917-1918



5000

5500

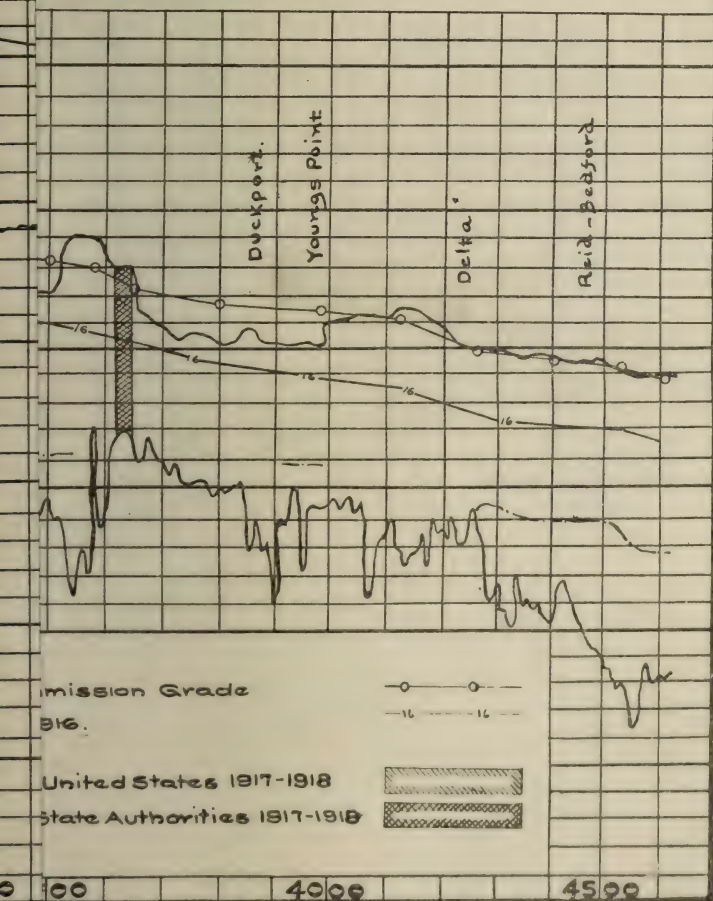


MISSISSIPPI RIVER COMMISSION  
Third District  
LOWER YAZOO LEVEES  
Prepared under the direction of  
A.M. TODD District Engineer  
E.C. Tollinger Asst. Engr.  
Traced by T.B.L. May 1918

Vicksburg, Miss.  
To accompany Annual Report for  
Fiscal Year ending June 30 1918  
*A.M. Todd*  
Assistant Engineer in Charge

Established 1914 Commission Grade  
High water level of 1916.  
Reaches improved by United States 1917-1918  
Reaches improved by State Authorities 1917-1918

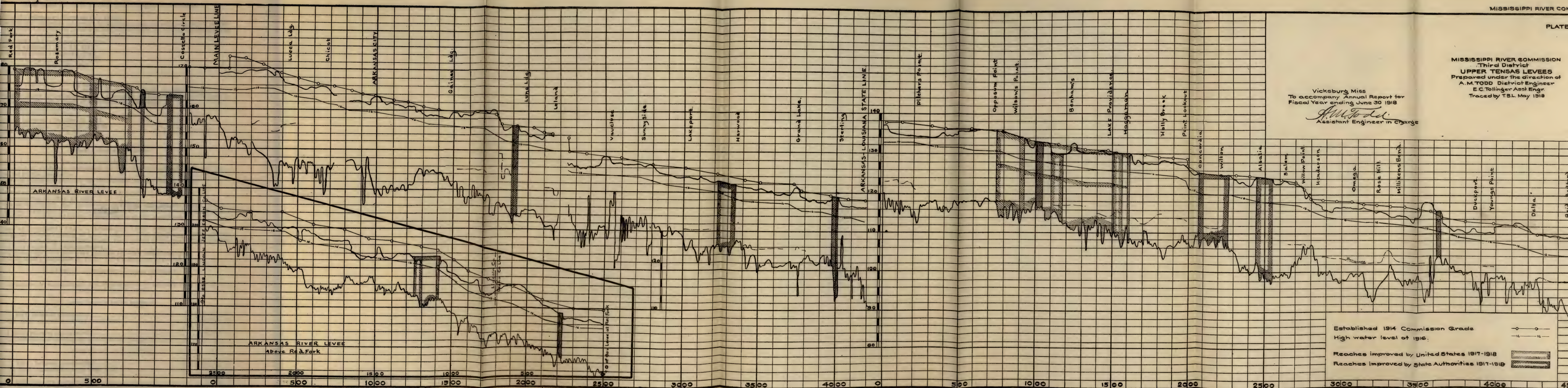
MISSISSIPPI RIVER COMMISSION  
 Third District  
**UPPER TENSAS LEVEES**  
 Prepared under the direction of  
 A.M. TODD District Engineer  
 E.C. Tollinger Asst. Engr.  
 Traced by T.B.L. May 1918



MISSISSIPPI RIVER COMMISSION  
Third District  
UPPER TENNESSEAN LEVEES  
Prepared under the direction of  
A.M. TODD District Engineer  
E.C. Tollinger Asst. Engr.  
Traced by T.B.L. May 1918

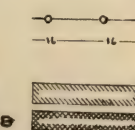
Vicksburg Miss  
To accompany Annual Report for  
Fiscal Year ending June 30 1918

*A.M. Todd*  
Assistant Engineer in Charge



Established 1914 Commission Grade  
High water level of 1916.

Reaches improved by United States 1917-1918  
Reaches improved by State Authorities 1917-1918



## LEVEE WORK IN UPPER TENSAS LEVEE DISTRICT IN ARKANSAS.

Name of contractor: Hercules Co., (Ltd.).

Amount and character of work: Enlarging levees on Arkansas River to Mississippi River Commission grade and section, stations 191 to 500, involving about 265,000 cubic yards of earthwork embankment.

Unit price: 23.3 cents per cub'c yard.

Date of contract: July 16, 1917.

Date of approval: August 1, 1917.

Date work begun: August 17, 1917.

Time limit: December 31, 1918.

Completed: 13 per cent.

Name of contractor: Roach, Stansell & Co.

Amount and character of work: Enlarging levees on Arkansas River to Mississippi River Commission grade and section, stations 530+15 to 743, involving about 680,000 cubic yards of earthwork embankment.

Unit price: 23.75 cents per cubic yard.

Date of contract: October 6, 1916.

Date of approval: October 18, 1916.

Date work begun: November 3, 1916.

Time limit: December 1, 1919.

Completed: 63 per cent.

## MISCELLANEOUS CONTRACTS.

Name of contractor: Tennessee Contracting Co.

Character of contract: Permission to cut willows from all lands owned or controlled by the contractor.

Price: 10 cents per cord for all willows cut by the United States.

Date of contract: January 15, 1915.

Date of approval: January 13, 1915.

Date work begun: May 10, 1915.

Date of expiration and percentage completed can not be stated, as they depend on expiration of options controlled by the contractor and quantities of brush that may be cut by the United States in the meantime.

Name of contractor: Yazoo & Mississippi Valley Railroad Co.

Character: Lease of strip of land bordering third Mississippi River district pair yard, including use of side track, for a period of five years from October 1, 1914, to October 9, 1919, inclusive.

Rent price: \$374 for first year and \$24 for each subsequent year.

Date of lease: November 2, 1914. (Not subject to approval.)

## FINANCIAL STATEMENT—THIRD DISTRICT.

*Appropriation for maintenance and improvement of existing river and harbor works, act Oct. 2, 1914.*

## UPPER TENSAS LEVEE DISTRICT.

|                                                       |              |
|-------------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                      | \$180,018.45 |
| June 30, 1918, expended during fiscal year            | 43,560.27    |
| July 1, 1918, balance unexpended                      | 136,458.18   |
| July 1, 1918, amount covered by uncompleted contracts | 136,458.18   |

## LOWER YAZOO LEVEE DISTRICT.

|                                                       |            |
|-------------------------------------------------------|------------|
| July 1, 1917, balance unexpended                      | 111,447.62 |
| June 30, 1918, expended during fiscal year            | 36,092.46  |
| July 1, 1918, balance unexpended                      | 75,355.16  |
| July 1, 1918, amount covered by uncompleted contracts | 75,355.16  |

## 3672 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

*Appropriation for maintenance and improvement of existing river and harbor works, act Mar. 4, 1915.*

## UPPER TENSAS LEVEE DISTRICT.

|                                            |             |
|--------------------------------------------|-------------|
| July 1, 1917, balance unexpended           | \$34,501.59 |
| June 30, 1918, expended during fiscal year | 34,501.59   |

## LOWER YAZOO LEVEE DISTRICT.

|                                            |          |
|--------------------------------------------|----------|
| July 1, 1917, balance unexpended           | 7,620.51 |
| June 30, 1918, expended during fiscal year | 7,620.51 |

## SURVEYS, THIRD DISTRICT.

|                                            |          |
|--------------------------------------------|----------|
| July 1, 1917, balance unexpended           | 2,548.92 |
| June 30, 1918, expended during fiscal year | 2,548.92 |

## ASHBROOK NECK, MISS.

|                                            |           |
|--------------------------------------------|-----------|
| July 1, 1917, balance unexpended           | 26,774.83 |
| June 30, 1918, expended during fiscal year | 26,774.83 |

*Appropriation for Mississippi River, river and harbor act July 27, 1916.*

## UPPER TENSAS LEVEE DISTRICT.

|                                                       |                  |
|-------------------------------------------------------|------------------|
| July 1, 1917, balance unexpended                      | \$303,449.05     |
| Overpayments in fiscal year 1917 collected            | 5.00             |
|                                                       | <hr/> 303,454.05 |
| June 30, 1918, expended during fiscal year            | 172,886.64       |
|                                                       | <hr/> 130,567.41 |
| July 1, 1918, balance unexpended                      | 130,567.41       |
| July 1, 1918, outstanding liabilities                 | \$3,460.27       |
| July 1, 1918, amount covered by uncompleted contracts | 114,017.26       |
|                                                       | <hr/> 117,477.53 |
| July 1, 1918, balance available                       | 13,089.88        |

## LOWER YAZOO LEVEE DISTRICT.

|                                                       |                  |
|-------------------------------------------------------|------------------|
| July 1, 1917, balance unexpended                      | 104,620.02       |
| Reimbursable accounts settled                         | 14.00            |
| Overpayments in fiscal year 1917 collected            | 362.83           |
|                                                       | <hr/> 104,996.85 |
| June 30, 1918, expended during fiscal year            | \$40,472.43      |
| Transferred to Ashbrook Dike, Miss                    | 30,000.00        |
| Transferred to Plant, third district                  | 20,000.00        |
|                                                       | <hr/> 90,472.43  |
| July 1, 1918, balance unexpended                      | 14,524.42        |
| July 1, 1918, amount covered by uncompleted contracts | 14,524.42        |

## SURVEYS, THIRD DISTRICT.

|                                            |          |
|--------------------------------------------|----------|
| July 1, 1917, balance unexpended           | 5,000.00 |
| June 30, 1918, expended during fiscal year | 5,000.00 |

## LAKE BOLIVAR FRONT, MISS.

|                                       |                |
|---------------------------------------|----------------|
| July 1, 1917, balance unexpended      | 3,862.45       |
| July 1, 1918, balance unexpended      | 3,862.45       |
| July 1, 1918, outstanding liabilities | 2,047.82       |
|                                       | <hr/> 1,814.63 |
| July 1, 1918, balance available       | 1,814.63       |

## ASHBROOK NECK, MISS.

|                                            |             |
|--------------------------------------------|-------------|
| July 1, 1917, balance unexpended           | \$38,345.62 |
| Reimbursable accounts settled              | 248.60      |
|                                            | <hr/>       |
| June 30, 1918, expended during fiscal year | 38,594.22   |
|                                            | 38,594.22   |

## ASHBROOK DIKE, MISS.

|                                             |            |
|---------------------------------------------|------------|
| July 1, 1917, balance unexpended            | 114,326.87 |
| Transferred from lower Yazoo levee district | 30,000.00  |
|                                             | <hr/>      |
| June 30, 1918, expended during fiscal year  | 144,326.87 |
|                                             | 132,152.05 |
|                                             | <hr/>      |
| July 1, 1918, balance unexpended            | 12,174.82  |
| July 1, 1918, outstanding liabilities       | 4,343.53   |
|                                             | <hr/>      |
| July 1, 1918, balance available             | 7,831.29   |

## PANTHER FOREST, ARK.

|                                            |           |
|--------------------------------------------|-----------|
| July 1, 1917, balance unexpended           | 26,623.94 |
| June 30, 1918, expended during fiscal year | 26,623.94 |

## FITLERS BEND, MISS.

|                                            |        |
|--------------------------------------------|--------|
| July 1, 1917, balance unexpended           | 192.26 |
| June 30, 1918, expended during fiscal year | 192.26 |

## COTTONWOOD, MISS.

|                                            |          |
|--------------------------------------------|----------|
| July 1, 1917, balance unexpended           | 5,633.72 |
| Overpayments in fiscal year 1917 collected | .11      |
|                                            | <hr/>    |
| June 30, 1918, expended during fiscal year | 5,633.83 |
|                                            | 5,633.83 |

## VICKSBURG, MISS.

|                                            |           |
|--------------------------------------------|-----------|
| July 1, 1917, balance unexpended           | 30,040.64 |
| Reimbursable accounts settled              | 37.00     |
|                                            | <hr/>     |
| June 30, 1918, expended during fiscal year | 30,077.64 |
|                                            | 30,077.64 |

## REID-BEDFORD BEND, LA.

|                                            |             |
|--------------------------------------------|-------------|
| July 1, 1917, balance unexpended           | 73,520.39   |
| Reimbursable accounts settled              | 65.56       |
|                                            | <hr/>       |
| June 30, 1918, expended during fiscal year | 73,585.95   |
| Transferred to plant, third district       | \$43,585.95 |
|                                            | 30,000.00   |
|                                            | <hr/>       |
|                                            | 73,585.95   |

## RED FORK, ARK.

|                                            |           |
|--------------------------------------------|-----------|
| July 1, 1917, balance unexpended           | 12,023.07 |
| Overpayments in fiscal year 1917 collected | 3.00      |
|                                            | <hr/>     |
| June 20, 1918, expended during fiscal year | 12,026.07 |
|                                            | 12,026.07 |

## REPAIRS TO EXISTING WORKS AND STONE.

|                                            |             |
|--------------------------------------------|-------------|
| July 1, 1917, balance unexpended           | \$45,966.11 |
| Reimbursable accounts settled              | 35.00       |
|                                            | 46,001.11   |
| June 30, 1918, expended during fiscal year | 46,001.11   |

## PLANT, THIRD DISTRICT.

|                                             |           |
|---------------------------------------------|-----------|
| July 1, 1917, balance unexpended            | 74,828.80 |
| Transferred from lower Yazoo levee district | 20,000.00 |
| Transferred from Reid-Bedford Bend, La.     | 30,000.00 |
| Receipts from sales                         | 2,674.11  |
| Receipts from rent of plant                 | 6,900.82  |
| Reimbursable accounts settled               | 1,275.00  |

|                                            |            |
|--------------------------------------------|------------|
|                                            | 135,678.80 |
| June 30, 1918, expended during fiscal year | 119,168.60 |

|                                       |           |
|---------------------------------------|-----------|
| July 1, 1918, balance unexpended      | 16,510.28 |
| July 1, 1918, outstanding liabilities | 16,510.28 |

*Appropriation for flood control, Mississippi River, and Sacramento River, Cal. sundry civil act June 12, 1917.*

## UPPER TENSAS LEVEE DISTRICT.

|                                            |              |
|--------------------------------------------|--------------|
| August 7, 1917, approved allotment         | \$420,000.00 |
| June 30, 1918, expended during fiscal year | 175,202.62   |

|                                                       |             |
|-------------------------------------------------------|-------------|
| July 1, 1918, balance unexpended                      | 244,797.38  |
| July 1, 1918, outstanding liabilities                 | \$65,894.08 |
| July 1, 1918, amount covered by uncompleted contracts | 83,178.33   |
|                                                       | 149,072.41  |

|                                 |           |
|---------------------------------|-----------|
| July 1, 1918, balance available | 95,724.97 |
|---------------------------------|-----------|

## LOWER YAZOO LEVEE DISTRICT.

|                                                                  |            |
|------------------------------------------------------------------|------------|
| Aug. 7, 1917, approved allotment                                 | 420,000.00 |
| Transferred from Star Landing, Miss., first and second districts | 120,000.00 |

|                                            |            |
|--------------------------------------------|------------|
|                                            | 540,000.00 |
| June 30, 1918, expended during fiscal year | 242,022.68 |

|                                                       |             |
|-------------------------------------------------------|-------------|
| July 1, 1918, balance unexpended                      | 297,977.32  |
| July 1, 1918, outstanding liabilities                 | \$85,089.60 |
| July 1, 1918, amount covered by uncompleted contracts | 167,028.73  |
|                                                       | 252,118.33  |

|                                 |           |
|---------------------------------|-----------|
| July 1, 1918, balance available | 45,858.99 |
|---------------------------------|-----------|

## SURVEYS, THIRD DISTRICT.

|                                            |          |
|--------------------------------------------|----------|
| Aug. 7, 1917, approved allotment           | 5,000.00 |
| June 30, 1918, expended during fiscal year | 491.48   |

|                                       |          |
|---------------------------------------|----------|
| July 1, 1918, balance unexpended      | 4,508.52 |
| July 1, 1918, outstanding liabilities | 2,272.75 |

|                                 |          |
|---------------------------------|----------|
| July 1, 1918, balance available | 2,235.77 |
|---------------------------------|----------|

## ASHBROOK NECK, MISS.

|                                            |           |
|--------------------------------------------|-----------|
| Aug. 7, 1917, approved allotment           | 72,000.00 |
| June 30, 1918, expended during fiscal year | 64,550.68 |

|                                       |          |
|---------------------------------------|----------|
| July 1, 1918, balance unexpended      | 7,449.32 |
| July 1, 1918, outstanding liabilities | 3,721.47 |

|                                 |          |
|---------------------------------|----------|
| July 1, 1918, balance available | 3,727.85 |
|---------------------------------|----------|

## FITLERS BEND, MISS.

|                                            |              |
|--------------------------------------------|--------------|
| Aug. 7, 1917, approved allotment           | \$130,000.00 |
| June 30, 1918, expended during fiscal year | 123,957.04   |
| July 1, 1918, balance unexpended           | 6,042.96     |
| July 1, 1918, outstanding liabilities      | 4,471.47     |
| July 1, 1918, balance available            | 1,571.49     |

## COTTONWOOD, MISS.

|                                            |            |
|--------------------------------------------|------------|
| Aug. 7, 1917, approved allotment           | 140,000.00 |
| Reimbursable accounts settled              | 222.50     |
| June 30, 1918, expended during fiscal year | 140,222.50 |
| July 1, 1918, balance unexpended           | 13,298.91  |
| July 1, 1918, outstanding liabilities      | 10,870.47  |
| July 1, 1918, balance available            | 2,428.44   |

## REID-BEDFORD BEND, LA.

|                                            |           |
|--------------------------------------------|-----------|
| Aug. 7, 1917, approved allotment           | 52,000.00 |
| June 30, 1918, expended during fiscal year | 10,994.95 |
| July 1, 1918, balance unexpended           | 41,005.05 |
| July 1, 1918, outstanding liabilities      | 19,073.54 |
| July 1, 1918, balance available            | 21,931.51 |

## GREENVILLE, MISS.

|                                            |           |
|--------------------------------------------|-----------|
| Aug. 7, 1917, approved allotment           | 40,000.00 |
| Reimbursable accounts settled              | 1,324.13  |
| June 30, 1918, expended during fiscal year | 41,324.13 |
| July 1, 1918, balance available            | 41,324.13 |

## PRINCETON, MISS.

|                                            |            |
|--------------------------------------------|------------|
| Aug. 7, 1917, approved allotment           | 120,000.00 |
| Reimbursable accounts settled              | 264.50     |
| June 30, 1918, expended during fiscal year | 120,264.50 |
| July 1, 1918, balance unexpended           | 84,270.84  |
| July 1, 1918, outstanding liabilities      | 35,993.66  |
| July 1, 1918, balance available            | 11,359.13  |
| July 1, 1918, balance available            | 24,634.53  |

## GRAND LAKE, ARK.

|                                            |           |
|--------------------------------------------|-----------|
| Aug. 7, 1917, approved allotment           | 80,000.00 |
| June 30, 1918, expended during fiscal year | 46,302.08 |
| July 1, 1918, balance unexpended           | 33,697.92 |
| July 1, 1918, outstanding liabilities      | 21,593.72 |
| July 1, 1918, balance available            | 12,104.20 |

## REPAIRS TO EXISTING WORKS AND STONE.

|                                                 |             |
|-------------------------------------------------|-------------|
| Aug. 7, 1917, approved allotment-----           | \$50,000.00 |
| Reimbursable accounts settled-----              | 3,145.00    |
|                                                 | <hr/>       |
| June 30, 1918, expended during fiscal year----- | 53,145.00   |
|                                                 | <hr/>       |
| July 1, 1918, balance unexpended-----           | 35,686.40   |
| July 1, 1918, outstanding liabilities-----      | 17,458.00   |
|                                                 | <hr/>       |
| July 1, 1918, outstanding liabilities-----      | 13,058.40   |
|                                                 | <hr/>       |
| July 1, 1918, balance available-----            | 4,400.00    |

## PLANT, THIRD DISTRICT.

|                                                                                                                       |            |
|-----------------------------------------------------------------------------------------------------------------------|------------|
| Aug. 7, 1917, approved allotment-----                                                                                 | 108,000.00 |
| Reimbursable accounts settled-----                                                                                    | 4,196.20   |
|                                                                                                                       | <hr/>      |
| June 30, 1918, expended during fiscal year-----                                                                       | 112,196.20 |
|                                                                                                                       | <hr/>      |
| July 1, 1918, balance unexpended-----                                                                                 | 109,628.80 |
| July 1, 1918, outstanding liabilities-----                                                                            | 2,567.80   |
|                                                                                                                       | <hr/>      |
| July 1, 1918, outstanding liabilities-----                                                                            | 2,567.80   |
|                                                                                                                       | <hr/>      |
| <i>Appropriation for increase of compensation, rivers and harbors, 1918, sundry civil act, June 12, 1917.</i>         |            |
| June 30, 1918, expended during fiscal year-----                                                                       | \$4,592.60 |
| July 1, 1918, outstanding liabilities-----                                                                            | 493.30     |
|                                                                                                                       | <hr/>      |
| <i>Funds contributed for flood control, Mississippi River, special fund, under flood-control act of Mar. 1, 1917.</i> |            |

## UPPER TENNESSEE LEVEE DISTRICT.

|                                                            |             |
|------------------------------------------------------------|-------------|
| Contributed by—                                            |             |
| Fifth Louisiana levee district-----                        | \$71,334.00 |
| Southeast Arkansas levee district-----                     | 46,666.67   |
| Tennessee Basin levee district-----                        | 92,000.00   |
|                                                            | <hr/>       |
| June 30, 1918, expended during fiscal year-----            | 210,000.67  |
|                                                            | <hr/>       |
| July 1, 1918, balance unexpended-----                      | 70,373.70   |
| July 1, 1918, outstanding liabilities-----                 | 139,626.92  |
| July 1, 1918, outstanding liabilities-----                 | \$42,655.25 |
| July 1, 1918, amount covered by uncompleted contracts----- | 46,666.67   |
|                                                            | <hr/>       |
|                                                            | 89,321.92   |
|                                                            | <hr/>       |
| July 1, 1918, balance available-----                       | 50,305.00   |

## LOWER YAZOO LEVEE DISTRICT.

|                                                              |             |
|--------------------------------------------------------------|-------------|
| Contributed by Board of Mississippi Levee Commissioners----- | 270,001.00  |
| June 30, 1918, expended during fiscal year-----              | 128,526.00  |
|                                                              | <hr/>       |
| July 1, 1918, balance unexpended-----                        | 141,474.99  |
| July 1, 1918, outstanding liabilities-----                   | \$30,824.50 |
| July 1, 1918, amount covered by uncompleted contracts-----   | 87,719.94   |
|                                                              | <hr/>       |
|                                                              | 118,544.44  |
|                                                              | <hr/>       |
| July 1, 1918, balance available-----                         | 22,930.50   |

## GREENVILLE, MISS.

|                                                 |           |
|-------------------------------------------------|-----------|
| Contributed by—                                 |           |
| Board of Mississippi Levee Commissioners-----   | 22,500.00 |
| City of Greenville, Miss-----                   | 13,000.00 |
|                                                 | <hr/>     |
|                                                 | 35,500.00 |
|                                                 | <hr/>     |
| June 30, 1918, expended during fiscal year----- | 35,500.00 |

*Miscellaneous receipts.*

|                                                                               |           |
|-------------------------------------------------------------------------------|-----------|
| June 17, 1917, receipts from rent-----                                        | \$100. 00 |
| July 18, 1917, deposited to credit of the Treasurer of the United States----- | 100. 00   |

## APPENDIX 4.

## IMPROVING MISSISSIPPI RIVER, FOURTH DISTRICT.

This district extends from Warrenton, Miss.,  $7\frac{1}{2}$  miles below Vicksburg, Miss., to the Head of the Passes, about 13 miles from the Gulf of Mexico, a distance of 453 miles by river.

District headquarters: New Orleans, La.

District engineer: Lieut. Col. George McC. Derby, United States Army, retired.

President, Mississippi River Commission: Col. James G. Warren, Corps of Engineers, United States Army, acting president to July 10, 1917; Brig. Gen. W. H. Bixby, United States Army, acting president, July 10-18, 1917; president since.

## WORKS.

## I. Revetments:

- (a) Hard Times Bend.
- (b) Bondurant Chute.
- (c) Kempe Bend.
- (d) Harbors at Natchez, Miss., and Vidalia, La.
- (e) Junction of the Mississippi, Red, and Atchafalaya Rivers.
- (f) Grand Bay.
- (g) Plaquemine, La.
- (h) Harbor at New Orleans, La.
- (i) General repairs and stone.

## II. Levees:

- (a) Lower Tensas levee district.
- (b) Atchafalaya levee district.
- (c) Lafourche levee district.
- (d) Barataria levee district.
- (e) Homochitto levee district.
- (f) Pontchartrain levee district.
- (g) Lake Borgne levee district.

## III. Surveys.

## IV. Plant:

- (a) Revetment plant.
- (b) Levee plant.

## I. REVETMENTS.

(a) *Hard Times Bend.*

*Location and description.*—Six hundred and thirty-three miles below Cairo, right bank.

*Original condition.*—Caving in this bend has been in progress from an early date. The exact date when caving commenced is not known. The caving continued until, in 1910, it threatened the controlling levee line crossing the foot of Lake St. Joseph. The destruction of this line would necessitate the building of a long and expensive loop levee back of the lake and the abandonment of much valuable land.

*Previous projects.*—None.

*Existing project.*—The present project was adopted by the Mississippi River Commission in 1910 and is to protect, with standard revetment of willow mattresses and upper-bank paving, those caving banks where the levee line in Hard Times Bend is most threatened.

*Operations and results during fiscal year.*—No construction work was done during the year. The expenditures, amounting to \$8,636.37, were for surveys, material, and proportion of care, repair, and maintenance of plant belonging to revetment works in the district.

*Condition at end of fiscal year.*—The effective length of the revetment, 7,689 linear feet, consisting of brush mattresses from 300 to 400 feet wide for the ubiquitous bank, and rock or concrete pavement for upper-bank protection. Extension of the work upstream for about 2,000 feet and downstream for about 1,000 feet will be required to protect the threatened part of the levee line; it will have to be further extended from time to time. The revetment in place is apparently in good condition, except at the ends, where there has been some loss.

The expenditures on existing project to end of fiscal year were \$263,506 for new work and \$50,407.02 for maintenance, making a total of \$313,913.85.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the improvement has been to permanently locate, and deepen the channel, to protect the banks of the river and to preserve the controlling levee line.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and make such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$313,913.85:

|                                       |           |
|---------------------------------------|-----------|
| New work                              | \$263,506 |
| Maintenance                           | 50,407    |
| Net total expended                    | 313,913   |
| Total appropriations to June 30, 1918 | 401,165   |

| Fiscal year ending June 30.           | 1914         | 1915       | 1916        | 1917        | 1918    |
|---------------------------------------|--------------|------------|-------------|-------------|---------|
| Expended for new work <sup>2</sup>    | \$140,609.13 | \$9,691.59 | \$90,012.77 | \$21,390.58 |         |
| Expended for maintenance <sup>2</sup> |              | 507.76     | 6,903.10    | 31,952.51   | \$8,636 |
| Total expended <sup>2</sup>           | 140,609.13   | 10,199.35  | 96,915.87   | 53,343.09   | 8,636   |
| Appropriated or allotted              | 10,000.00    | 126,000.00 | 100,000.00  | 25,165.18   |         |

July 1, 1917, balance unexpended \$75,722.  
Amount appropriated by sundry civil act approved June 12, 1917 25,165.

100,887.

Deduction on account of transfer to first and second Mississippi River districts 5,000.

95,887.

June 30, 1918, amount expended during fiscal year, <sup>2</sup> for maintenance 8,636.

July 1, 1918, balance unexpended 87,251.

July 1, 1918, balance available for maintenance for fiscal year ending June 30, 1919 87,251.

Amount (estimated) required to be appropriated for completion of existing project <sup>3</sup> Indeterminate.

Amount that can be profitably expended in fiscal year ending June 30, 1920:

For new work <sup>3</sup> Indeterminate  
For maintenance <sup>3</sup> Indeterminate

<sup>1</sup> Total amount, \$406,165.18, \$5,000.01 transferred to first and second Mississippi River districts.

<sup>2</sup> Not deducting receipts from sales, etc.

<sup>3</sup> Exclusive of available funds.

(b) *Bondurant Chute.*

*Location and description.*—Six hundred and forty-three miles below Cairo, right bank.

*Original condition.*—Caving in this bend commenced in 1880, and continued until 1889, when it threatened the line of levee between the river and Lake Bruin. The abandonment of the existing levee would have necessitated the construction of a long line of new levee behind Lake Bruin and the exposure to overflow of a large area of cultivated land.

*Previous projects.*—None.

*Existing project.*—The present project was adopted by the Mississippi River Commission in 1899, and provided for revetting the caving bank with board mattresses 100 feet wide, grading the upper bank and paving it with concrete in situ. The project was modified in 1900 to provide for the use of standard mattresses of willow brush. A further modification in 1903 provided for the use of rock for upper bank paving.

*Operations and results during fiscal year.*—Work at this locality consisted of making extensive repairs between sections 6 and 10. Practically new revetment was required covering about 1,400 linear feet of bank. The upper bank was graded by hand and paved with rock for 1,145 linear feet, requiring 815 squares, and the subaqueous bank matted 300 feet wide for 1,400 linear feet, requiring the placing of 3,500 squares.

Operations were commenced September 24, 1917, and continued from time to time as plant was available and the stage of the river permitted work, until March 28, 1918, when all work contemplated was completed.

The work was done by hired labor with Government plant at a total cost of \$57,231.16 for maintenance. The field cost amounted to \$56,412.82 and the actual money expended \$42,310.92 the difference being due to credits for materials on hand.

The detailed costs are shown in the following tables:

## BONDURANT CHUTE (643 R), FOURTH DISTRICT.

*Mattresses, total area, 3,500 squares.*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$781.40    |             | \$0.223 |
| Lumber.....feet..                    | 200,576         | 3,630.23    | 57,307      | 1.037   |
| Wire No. 12.....pounds..             | 1,429           | 60.49       | .408        | .017    |
| Nails, wire.....                     | 22,238          | 839.40      | 6.354       | .240    |
| Treenails.....number..               | 31,576          | 69.12       | 9.022       | .020    |
| Brush and poles.....cords..          | 3,580           | 8,509.95    | 1.023       | 2.431   |
| Coal.....tons..                      | 12              | 69.00       | .003        | .020    |
| Oil.....tons..                       | 170             | 35.90       | .048        | .010    |
| Miscellaneous expenses.....          |                 | 775.34      |             | .222    |
| Subsistence.....                     |                 | 3,669.58    |             | 1.048   |
| Steamboat expenses.....              |                 | 2,722.50    |             | .778    |
| Labor.....                           |                 | 6,390.01    |             | 1.826   |
| Supervision.....                     |                 | 880.00      |             | .251    |
| Total field cost.....                |                 | 28,432.92   |             | 8.123   |

BONDURANT CHUTE (643 R), FOURTH DISTRICT—continued.  
*Channel mats, 3,064 squares; connecting mats, 436 squares.*  
 BALLASTING AND SINKING.

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$184.76    |             | \$0.06 |
| Lumber.....feet.....                 | 2,422           | 48.44       | 0.692       | .06    |
| Wire No. 12.....pounds.....          | 1,200           | 53.28       | .343        | .06    |
| Nails, wire.....                     | 1,974           | 78.77       | .564        | .06    |
| Stone.....tons.....                  | 2,728           | 7,595.17    | .779        | 2.37   |
| Coal.....do.....                     | 6               | 34.50       | .002        | .06    |
| Oil.....do.....                      | 60              | 6.00        | .017        | .06    |
| Miscellaneous expenses.....          |                 | 340.12      |             | .06    |
| Subsistence.....                     |                 | 1,230.66    |             | .37    |
| Steamboat expenses.....              |                 | 2,940.00    |             | .88    |
| Labor.....                           |                 | 2,357.06    |             | .69    |
| Supervision.....                     |                 | 471.41      |             | .14    |
| Total field cost.....                |                 | 15,340.17   |             | 4.37   |

*Grading, 1,145 linear feet, or 815 squares.*

| Items.                      | Quantity used.  |             | Per square. |        |
|-----------------------------|-----------------|-------------|-------------|--------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Oil.....                    | 75              | \$42.04     | 0.092       | \$0.06 |
| Miscellaneous expenses..... |                 | 4.10        |             | .06    |
| Subsistence.....            |                 | 218.95      |             | .27    |
| Labor.....                  |                 | 545.79      |             | .67    |
| Supervision.....            |                 | 99.79       |             | .12    |
| Total field cost.....       |                 | 910.67      |             | 1.18   |

*Paving (rock and concrete), 1,145 linear feet, or 815 squares.*

| Items.                               | Quantity used.  |             | Per square. |        |
|--------------------------------------|-----------------|-------------|-------------|--------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.  |
| Mobilization and demobilization..... |                 | \$143.07    |             | \$0.17 |
| Stone.....tons.....                  | 3,026           | 8,402.26    | 3.713       | 10.33  |
| Miscellaneous expenses.....          |                 | 111.25      |             | .14    |
| Subsistence.....                     |                 | 771.56      |             | .94    |
| Steamboat expenses.....              |                 | 108.35      |             | .13    |
| Labor.....                           |                 | 1,424.28    |             | 1.74   |
| Supervision.....                     |                 | 287.54      |             | .35    |
| Total field cost.....                |                 | 11,248.31   |             | 13.88  |

*Summary of costs (1,400 linear feet revetment).*

|                                          | Subaqueous work. |           | Upper bank work.         |           | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|-----------|--------------------------|-----------|--------------|-----------------------------|
|                                          | Per square.      | Total.    | Per square. <sup>1</sup> | Total.    |              |                             |
| Total field cost.....                    | 12.506           | 43,773.09 | 14.919                   | 12,158.98 | 55,932.07    | 38.97                       |
| Office expenses.....                     | .183             | 642.00    | .216                     | 176.34    | 818.34       | .58                         |
| Surveys <sup>2</sup> .....               | .107             | 376.00    | .128                     | 104.75    | 480.75       | .34                         |
| Care of plant <sup>3</sup> .....         | .052             | 179.00    | .061                     | 49.62     | 228.62       | .16                         |
| Repair of plant.....                     | .219             | 764.00    | .256                     | 209.00    | 973.00       | .69                         |
| Depreciation of plant <sup>4</sup> ..... | .676             | 2,367.70  | .806                     | 656.59    | 3,024.29     | 2.16                        |
| Total.....                               | 13.743           | 48,101.79 | 16.386                   | 13,355.28 | 61,457.07    | 43.83                       |

<sup>1</sup> Cost per square completed upper bank work.

<sup>2</sup> This item includes actual cost of survey work done on this revetment.

<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>4</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of fiscal year.*—A total of 4,150 linear feet of bank protection has been placed, all of which is believed to be in good condition. Changes in the channel of the chute above has produced filling along the upper part of the revetment and scour in the channel along the lower part. There has been some little change in the bank line below the revetment but it is not believed that any further extension of the work will be required for several years.

The expenditures on existing project to the end of the fiscal year were \$2,452.82 for new work and \$70,217.99 for maintenance, making a total of \$132,670.81.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river and preserve the controlling levee line.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$132,670.81:

|                                             |             |
|---------------------------------------------|-------------|
| New work .....                              | \$62,452.82 |
| Maintenance .....                           | 70,217.99   |
| Net total expended .....                    | 132,670.81  |
| Total appropriations to June 30, 1918 ..... | 139,151.81  |

| Fiscal year ending June 30.                 | 1914       | 1915     | 1916       | 1917        | 1918        |
|---------------------------------------------|------------|----------|------------|-------------|-------------|
| Expended for new work <sup>1</sup> .....    | \$7,691.82 | \$957.45 | .....      | .....       | .....       |
| Expended for maintenance <sup>1</sup> ..... | 9,239      | 4,002    | \$1,210.71 | \$11,859.84 | \$42,310.97 |
| Total expended <sup>1</sup> .....           | 8,684.21   | 1,397.47 | 1,210.71   | 11,859.84   | 42,310.97   |
| Appropriated or allotted.....               | .....      | .....    | 35,000.00  | 25,651.81   | .....       |

<sup>1</sup> Not deducting receipts for sales, etc.

|                                                                                         |                            |
|-----------------------------------------------------------------------------------------|----------------------------|
| July 1, 1917, balance unexpended .....                                                  | \$23,140.16                |
| Amount appropriated by sundry civil act approved June 12, 1917 .....                    | 25,651.81                  |
| June 30, 1918, amount expended during fiscal year <sup>1</sup> for maintenance .....    | 58,791.97                  |
| July 1, 1918, balance unexpended .....                                                  | 42,310.97                  |
| July 1, 1918, outstanding liabilities, amount covered by uncompleted contracts .....    | 6,481.00                   |
| July 1, 1918, balance available, for maintenance .....                                  | 444.66                     |
| Amount available for fiscal year ending June 30, 1919 .....                             | 6,036.34                   |
| Amount (estimated) required to be appropriated for completion of existing project ..... | 6,036.34                   |
| Amount that can be profitably expended in fiscal year ending June 30, 1920 .....        | <sup>2</sup> Indeterminate |
|                                                                                         | <sup>3</sup> Indeterminate |

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

## (c) Kempe Bend.

*Location and description.*—Six hundred and fifty-eight miles below Cairo right bank.

*Original condition.*—Caving in this bend commenced about 1865 and continued with unusual rapidity, destroying one levee after another until 1899 when it had nearly reached a line the destruction of which would have necessitated a new levee of extremely difficult and costly construction. The construction of a new line would have required a long period of time, and a break in the front line in the meantime would have been disastrous to a large section of country.

*Previous projects.*—None.

*Existing project.*—The present project was adopted by the Mississippi River Commission in 1899, and provided for revetting the caving bend with standard revetment of willow mattresses and upper-bank paving of rock.

*Operations and results during fiscal year.*—Work in this bend consisted in restoring work lost and damaged by the high waters of 1915, 1916, and 1917. Repairs were made covering about 5,000 linear feet of bank, of which 3,555 feet consisted of entirely new work, requiring mats 300 to 600 feet wide, with upper bank protection of stone and concrete, where necessary.

The subaqueous bank was matted for 3,900 linear feet, requiring 14,576 squares; the upper bank was graded for 5,864 linear feet, and paved for 3,716 linear feet, requiring 564 squares of rock and 2,637 squares of concrete.

Operations were commenced July 26, 1917, and completed December 21, 1917.

The work was done by hired labor with Government plant at a total cost of \$150,324.76 for maintenance.

The field cost amounted to \$147,715.33, and the actual money expended \$128,790.29, the difference being due to credits for materials on hand.

The detailed costs are shown in the following tables:

## KEMPE BEND (658 R), FOURTH DISTRICT.

*Mattresses, total area, 14,576 squares (channel mats, 12,466 squares; connecting mats, 2,110 squares).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$718.96    |             | \$0.049 |
| Lumber.....feet.....                 | 791.134         | 13,443.93   | 54.276      | .922    |
| Wire No. 12.....pounds.....          | 4.692           | 175.95      | .322        | .012    |
| Nails, wire.....do.....              | 84.509          | 2,818.71    | 5.798       | .193    |
| Treenails.....No.....                | 126.800         | 265.95      | 8.699       | .018    |
| Brush and poles.....cords.....       | 15.002          | 24,115.75   | 1.029       | 1.654   |
| Rope, manila.....pounds.....         | 4.404           | 1,344.33    | .302        | .093    |
| Coal.....tons.....                   | 15              | 90.00       | .001        | .006    |
| Oil.....gallons.....                 | 150             | 15.00       | .010        | .001    |
| Miscellaneous expenses.....          |                 | 789.19      |             | .054    |
| Subsistence.....                     |                 | 6,078.00    |             | .418    |
| Steamboat expenses.....              |                 | 2,985.00    |             | .205    |
| Labor.....                           |                 | 12,686.19   |             | .870    |
| Supervision.....                     |                 | 2,424.40    |             | .166    |
| Total field cost.....                |                 | 67,951.35   |             | 4.661   |

## BALLASTING AND SINKING.

|                                      |        |           |       |         |
|--------------------------------------|--------|-----------|-------|---------|
| Mobilization and demobilization..... |        | \$719.62  |       | \$0.049 |
| Lumber.....feet.....                 | 31.978 | 639.56    | 2.194 | .045    |
| Wire No. 12.....pounds.....          | 3.700  | 164.28    | .254  | .012    |
| Nails, wire.....do.....              | 7.500  | 292.50    | .515  | .020    |
| Stone.....tons.....                  | 10.674 | 26,792.66 | .732  | 1.838   |
| Rope, manila.....pounds.....         | 4.404  | 1,344.33  | .302  | .093    |
| Sand and gravel.....cubic yards..... | 269    | 88.98     | .018  | .006    |
| Coal.....tons.....                   | 13     | 79.20     | .001  | .005    |
| Oil.....gallons.....                 | 200    | 42.81     | .014  | .003    |
| Miscellaneous expenses.....          |        | 1,448.57  |       | .099    |
| Subsistence.....                     |        | 3,313.70  |       | .227    |
| Steamboat expenses.....              |        | 6,530.00  |       | .448    |
| Labor.....                           |        | 5,865.57  |       | .402    |
| Supervision.....                     |        | 837.94    |       | .057    |
| Total field cost.....                |        | 48,159.72 |       | 3.304   |

KEMPE BEND (658 R), FOURTH DISTRICT—continued.

*Grading (5,864 linear feet or 6,111 squares).*

| Items.                      | Quantity used.  |             | Per square. |         |
|-----------------------------|-----------------|-------------|-------------|---------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Coal.....tons.....          | 125             | \$747.84    | 0.020       | \$0.122 |
| Oil.....gallons.....        | 175             | 89.19       | .029        | .015    |
| Miscellaneous expenses..... |                 | 231.81      |             | .038    |
| Subsistence.....            |                 | 2,527.20    |             | .414    |
| Steamboat expenses.....     |                 | 70.00       |             | .011    |
| Labor.....                  |                 | 5,253.05    |             | .859    |
| Supervision.....            |                 | 750.43      |             | .123    |
| Total field cost.....       |                 | 9,669.52    |             | 1.582   |

*Paving, rock and concrete (3,716 linear feet or 3,201 squares).*

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$93.34     |             | \$0.029 |
| Stone.....tons.....                  | 1,710           | 1,582.79    | 0.534       | .494    |
| Rope, manila.....pounds.....         | 4,404           | 1,344.33    | .302        | .420    |
| Cement.....sacks.....                | 12,568          | 7,429.59    | 3.926       | 2.321   |
| Sand and gravel.....cubic yards..... | 5,000           | 1,700.00    | 1.562       | .531    |
| Coal.....tons.....                   | 50              | 300.00      | .016        | .093    |
| Oil.....gallons.....                 | 60              | 30.93       | .019        | .010    |
| Miscellaneous expenses.....          |                 | 422.08      |             | .132    |
| Subsistence.....                     |                 | 1,627.60    |             | .509    |
| Steamboat expenses.....              |                 | 1,430.00    |             | .447    |
| Labor.....                           |                 | 3,742.28    |             | 1.169   |
| Supervision.....                     |                 | 534.61      |             | .167    |
| Total field cost.....                |                 | 20,237.55   |             | 6.322   |

*Summary of costs (3,900 linear feet revetted).*

|                                          | Subaqueous work. |              | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|--------------|--------------------------|-------------|--------------|-----------------------------|
|                                          | Per square.      | Total.       | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....                    | \$7.965          | \$116,111.08 | \$4.894                  | \$29,907.07 | \$146,018.15 | \$37.440                    |
| Office expenses.....                     | .142             | 2,074.70     | .087                     | 534.73      | 2,609.43     | .669                        |
| Surveys <sup>2</sup> .....               | .092             | 1,349.00     | .057                     | 348.18      | 1,697.18     | .435                        |
| are of plant <sup>3</sup> .....          | .135             | 1,970.40     | .082                     | 507.94      | 2,478.34     | .635                        |
| Repair of plant.....                     | .580             | 8,449.00     | .357                     | 2,176.20    | 10,625.20    | 2.724                       |
| Depreciation of plant <sup>4</sup> ..... | .437             | 6,348.00     | .268                     | 1,634.66    | 7,982.66     | 2.048                       |
| Total.....                               | 9.351            | 136,302.18   | 5.745                    | 35,108.78   | 171,410.96   | 43.951                      |

<sup>1</sup> Cost per square completed upper bank work.<sup>2</sup> This item includes actual cost of survey work done on this revetment.<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account inclement weather conditions or unfavorable river stages.<sup>4</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 10 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of fiscal year.*—A total of 28,616 linear feet of bank revetment has been placed consisting of brush mattresses for the subaqueous work from 200 to 500 feet wide, with upper bank pavement of rock, and concrete.

Numerous failures of the revetment have occurred since work was commenced in 1899 and extensive repairs have been necessary.

Additional work is necessary to restore work already lost by caving or threatened by scour along the outside edge of the mats. It is estimated that extensive repairs are needed covering about 4,000 linear feet of revetment mostly in the middle part of the revetment. The mattress work was completed in 1913 but additional paving will be needed, as well as a large expenditure for maintenance, for several years.

The expenditures on existing project to the end of the fiscal year were \$1,104,977.70 for new work and \$433,971.44 for maintenance, making a total of \$1,538,949.14.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the improvement has been to correct permanently locate and deepen the channel, to protect the banks of the river and to preserve the controlling levee line.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$1,538,949.14:

|                   |                   |
|-------------------|-------------------|
| New work.....     | \$1, 104, 977. 70 |
| Maintenance ..... | 433, 971. 44      |

|                         |                 |
|-------------------------|-----------------|
| Net total expended..... | 1, 538, 949. 14 |
|-------------------------|-----------------|

|                                            |                 |
|--------------------------------------------|-----------------|
| Total appropriations to June 30, 1918..... | 1, 541, 972. 79 |
|--------------------------------------------|-----------------|

| Fiscal year ending June 30.                 | 1914        | 1915        | 1916       | 1917        | 1918         |
|---------------------------------------------|-------------|-------------|------------|-------------|--------------|
| Expended for new work <sup>1</sup> .....    |             |             |            |             |              |
| Expended for maintenance <sup>1</sup> ..... | \$24,782.12 | \$52,142.03 | \$9,009.65 | \$54,602.40 | \$128,790.26 |
| Total expended <sup>1</sup> .....           | 24,782.12   | 52,142.03   | 9,009.65   | 54,602.40   | 128,790.26   |
| Appropriated or allotted.....               | 60,000.00   | 20,000.00   | 65,000.00  | 101,972.79  | .....        |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                  |             |
|------------------------------------------------------------------|-------------|
| July 1, 1917, balance unexpended.....                            | \$29,841.15 |
| Amount appropriated by sundry civil act approved June 12, 1917.. | 101,972.79  |

131,813.94

|                                                                                     |            |
|-------------------------------------------------------------------------------------|------------|
| June 30, 1918, amount expended during fiscal year <sup>1</sup> for maintenance..... | 128,790.29 |
|-------------------------------------------------------------------------------------|------------|

|                                       |          |
|---------------------------------------|----------|
| July 1, 1918, balance unexpended..... | 3,023.65 |
|---------------------------------------|----------|

|                                                      |          |
|------------------------------------------------------|----------|
| July 1, 1918, balance available for maintenance..... | 3,023.65 |
|------------------------------------------------------|----------|

|                                                            |          |
|------------------------------------------------------------|----------|
| Amount available for fiscal year ending June 30, 1919..... | 3,023.65 |
|------------------------------------------------------------|----------|

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
|----------------------------------------------------------------------------------------|-----------------------------|

|                                                                                 |                             |
|---------------------------------------------------------------------------------|-----------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920..... | <sup>2</sup> Indeterminate. |
|---------------------------------------------------------------------------------|-----------------------------|

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

*(d) Harbors at Natchez, Miss., and Vidalia, La.*

*Location and description.*—From 687 to 700 miles below Cairo, left and right banks.

*Original condition.*—Caving of the river banks in Giles and Marengo Bends, and in front of the city of Natchez, was in existence as far back as any authentic record exists. In Giles Bend the caving had progressed to such an extent that a cut-off was threatened through the neck of land between Giles and Cowpen Bends, which cut-off would have destroyed the harbors of Natchez and Vidalia, as well as causing a serious disturbance of the general régime of the river for many miles above and below. In Marengo Bend the caving had destroyed the last practicable line of levees between Lake Concordia and the river, and caused the construction of a new line behind the lake in 1881. Many thousand acres of valuable farming lands had been destroyed. The caving continued and in 1912 threatened the destruction of the new line behind the lake as well as an important railroad line. In front of the city of Natchez, continued caving had destroyed nearly all of the historic "Natchez-under-the-hill," and was threatening the site of the waterworks supplying the city of Natchez.

*Previous projects.*—The work originated in a congressional joint resolution passed June 28, 1879. The project provided for protecting the caving banks in Giles and Marengo Bends with brush and stone. Work was carried on under this project during 1881 and 1882. Amount expended \$82,470.91. No trace of this work remains.

*Existing project.*—Under act of August 2, 1882, the work was placed under the direction of the Mississippi River Commission, but remained dormant, except for frequent surveys and examinations, until 1892. On November 7, 1892, the commission adopted a project calling for the construction of a levee along the axis of Cowpen Neck to prevent the flow of water during high stages of the river across the neck and consequent danger of a cut-off. On March 30, 1897, a project was adopted for the protection of the bank in Giles Bend by means of submerged sloping spur dikes placed at intervals of about 450 feet. In 1899 the project was modified to provide for continuous revetment of the standard type, with mattresses 300 feet wide, together with upper-bank pavement, the latter to be placed only after the action of the river had graded the upper bank to a sufficiently flat slope. This restriction, so far as it related to work subsequent to 1899, was removed in June, 1900. In 1907 the project was modified to include the revetment of the Natchez front with standard revetment and in 1912 to include the revetment of Marengo Bend.

*Operations and results during fiscal year.*—The harbors of Natchez and Vidalia include improvement works in Giles Bend, Marengo Bend, and along the front of the city of Natchez.

*Giles Bend.*—Work in this bend consisted of restoring slopes of the spur levee and restoring pavement at outer end, where damaged by the high water of 1916-17, and repairing two breaks near the upper end of the revetment.

The slopes of the spur levee were restored for 2,200 linear feet, requiring about 9,000 cubic yards of earth, and the end and slopes of the levee were regraded and paved, requiring 150 squares of rock pavement.

The subaqueous bank was matted for 633 linear feet, requiring 3,708 squares, and upper-bank paving repaired for 200 linear feet, requiring 12 squares. Owing to the high stage of the river at the time the mattresses were placed it was not practicable to complete the paving of the upper bank.

The great width of the mattresses required to reach beyond deepest water in upper Giles, the shortage of labor, the scarcity of willows, and the swift current made the work slow and expensive.

Operations were commenced on repairs to levee on February 12, 1918. About April 1, 1918, the construction and sinking of mats was commenced and continued until June 30, 1918.

The work was done by hired labor with Government plant at a total cost of \$56,005.34 for maintenance.

The detailed field costs (exclusive of \$6,759.20 for maintenance of levee) which amounted to \$49,854.97, are shown in the following tables:

## GILES BEND (687 L), FOURTH DISTRICT.

*Mattresses, total area, 3,708 squares (channel mats, 2,626 squares; connecting mats, 1,082 squares).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$877.94    |             | \$0.237 |
| Lumber.....feet..                    | 185,771         | 3,803.28    | 50.100      | 1.026   |
| Wire, No. 12.....pounds..            | 1,891           | 85.28       | .510        | .023    |
| Nails, wire.....                     | 23,064          | 877.80      | 6.220       | .237    |
| Treenails.....number..               | 25,214          | 67.75       | 6.799       | .018    |
| Rope and poles.....cords..           | 4,200           | 11,000.00   | 1.133       | 2.966   |
| Rope, manila.....pounds..            | 2,977           | 908.00      | .802        | .245    |
| Coal.....tons..                      | 15              | 90.00       | .004        | .025    |
| Oil.....                             | 75              | 33.95       | .020        | .009    |
| Miscellaneous expenses.....          |                 | 533.79      |             | .144    |
| Subsistence.....                     |                 | 2,692.79    |             | .726    |
| Steamboat expenses.....              |                 | 2,200.00    |             | .593    |
| Labor.....                           |                 | 5,522.42    |             | 1.489   |
| Supervision.....                     |                 | 1,566.00    |             | .422    |
| Total field cost.....                |                 | 30,259.00   |             | 8.160   |

## BALLASTING AND SINKING.

|                                      |       |           |       |         |
|--------------------------------------|-------|-----------|-------|---------|
| Mobilization and demobilization..... |       | \$799.96  |       | \$0.215 |
| Lumber.....feet..                    | 4,400 | 90.71     | 1.186 | .024    |
| Wire, No. 12.....pounds..            | 1,372 | 61.88     | .370  | .017    |
| Nails, wire.....                     | 2,076 | 79.80     | .559  | .021    |
| Stone.....tons..                     | 3,107 | 9,385.20  | .838  | 2.531   |
| Rope, manila.....pounds..            | 2,977 | 908.00    | .803  | .245    |
| Coal.....tons..                      | 15    | 90.00     | .004  | .024    |
| Oil.....                             | 70    | 7.82      | .018  | .002    |
| Miscellaneous expenses.....          |       | 499.72    |       | .135    |
| Subsistence.....                     |       | 1,046.44  |       | .282    |
| Steamboat expenses.....              |       | 1,785.00  |       | .481    |
| Labor.....                           |       | 3,273.23  |       | .882    |
| Supervision.....                     |       | 484.00    |       | .133    |
| Total field cost.....                |       | 18,511.76 |       | 4.992   |

*Paving, rock and concrete (200 linear feet or 12 squares).*

| Items.                      | Quantity used.  |             | Per square. |         |
|-----------------------------|-----------------|-------------|-------------|---------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Rope, manila.....pounds..   | 27              | \$8.00      | 2.250       | \$0.667 |
| Miscellaneous expenses..... |                 | 38.36       |             | 3.197   |
| Subsistence.....            |                 | 31.51       |             | 2.626   |
| Labor.....                  |                 | 78.00       |             | 6.500   |
| Supervision.....            |                 | 10.00       |             | .833    |
| Total field cost.....       |                 | 165.87      |             | 13.823  |

GILES BEND (687 L), FOURTH DISTRICT—continued.

*Summary of cost (633 linear feet revetted).*

|                                          | Subaqueous work. |              | Upper bank work.         |           | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|--------------|--------------------------|-----------|--------------|-----------------------------|
|                                          | Per square.      | Total.       | Per square. <sup>1</sup> | Total.    |              |                             |
| total field cost.....                    | \$13. 153        | \$48,770. 76 | \$13. 822                | \$165. 87 | \$48,936. 63 | \$58. 747                   |
| office expenses.....                     | 1. 653           | 6,129. 06    | 1. 776                   | 21. 31    | 6,150. 37    | 7. 383                      |
| surveys <sup>2</sup> .....               | .246             | 914. 00      | .362                     | 4. 34     | 918. 34      | 1. 102                      |
| repair of plant <sup>3</sup> .....       | .247             | 916. 00      | 6. 906                   | 82. 87    | 998. 87      | 1. 199                      |
| repair of plant.....                     | 1. 130           | 4,191. 00    | 4. 438                   | 53. 25    | 4,244. 25    | 5. 096                      |
| depreciation of plant <sup>4</sup> ..... | .780             | 2,893. 00    | .813                     | 9. 76     | 2,902. 76    | 3. 485                      |
| Total.....                               | 17. 209          | 63,813. 82   | 28. 117                  | 337. 40   | 64,151. 22   | 77. 012                     |

<sup>1</sup> Cost per square completed upper bank work.<sup>2</sup> This item includes actual cost of survey work done on this revetment.<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>4</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 10 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Marengo Bend.*—Work during the year was confined to making repairs to existing revetment.

Considerable material was accumulated during the early part of the season and on November 9, 1917, grading of the upper bank was commenced and continued until January 31, 1918, when after sinking one mattress at section 20, it was found impracticable to continue the work on account of the swiftness of the current and shortage of labor.

A total of 873 squares of mattress was placed, covering 150 linear feet of bank; the upper bank was graded for 1,253 linear feet and paved for 950 linear feet, requiring 314 squares of pavement.

The work was done by hired labor with Government plant at a total cost of \$33,859.58 for maintenance.

The detailed field costs, which amounted to \$30,889.91, are shown in the following tables:

## MARENGO BEND (692 R), FOURTH DISTRICT.

*Mattresses, total area, 873 squares (channel mats, 663 squares; connecting mats, 210 squares).*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |          |
|--------------------------------------|-----------------|-------------|-------------|----------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.    |
| mobilization and demobilization..... |                 | \$450. 50   |             | \$0. 516 |
| umber.....feet.....                  | 47,325          | 905. 02     | 54. 212     | 1. 038   |
| ire, No. 12.....pounds.....          | 279             | 10. 46      | .319        | .013     |
| ils, wire.....                       | 4,954           | 176. 42     | 5. 674      | .202     |
| eenails.....number.....              | 7,071           | 13. 66      | 8. 091      | .016     |
| ush and poles.....cords.....         | 899             | 2,187. 12   | 1. 029      | 2. 505   |
| ope, manilla.....pounds.....         | 2,014           | 614. 33     | 2. 307      | .704     |
| al.....tons.....                     | 22              | 110. 00     | .026        | .126     |
| l.....gallons.....                   | 100             | 10. 00      | .114        | .011     |
| cellaneous expenses.....             |                 | 220. 32     |             | .252     |
| bsistence.....                       |                 | 1,750. 63   |             | 2. 005   |
| amboat expenses.....                 |                 | 960. 00     |             | 1. 099   |
| bor.....                             |                 | 2,251. 06   |             | 2. 578   |
| persivision.....                     |                 | 405. 39     |             | .464     |
| Total field cost.....                |                 | 10,064. 91  |             | 11. 529  |

## MARENGO BEND (692 R), FOURTH DISTRICT—continued.

Mattresses, total area, 873 squares (channel mats, 663 squares; connecting mats, 210 squares)—Continued.

## BALLASTING AND SINKING.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$598.47    |             | \$0.686 |
| Lumber.....feet..                    | 3,757           | 75.14       | 4.303       | .086    |
| Wire, No. 12.....pounds..            | 400             | 17.32       | .458        | .026    |
| Nails, wire.....                     | 600             | 24.00       | .687        | .027    |
| Stone.....tons..                     | 636             | 1,848.24    | .751        | 2.117   |
| Rope, manila.....pounds..            | 2,014           | 614.33      | 2.307       | .704    |
| Coal.....tons..                      | 5               | 25.00       | .005        | .029    |
| Oil.....gallons..                    | 125             | 37.51       | .143        | .043    |
| Miscellaneous expenses.....          |                 | 377.60      |             | .432    |
| Subsistence.....                     |                 | 264.60      |             | .303    |
| Steamboat expenses.....              |                 | 530.00      |             | .607    |
| Labor.....                           |                 | 696.61      |             | .798    |
| Supervision.....                     |                 | 99.51       |             | .114    |
| Total field cost.....                |                 | 5,208.33    |             | 5.966   |

## Grading (1,253 linear feet or 1,901 squares).

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$264.75    |             | \$0.139 |
| Coal.....tons..                      | 122             | 801.33      | 0.064       | .422    |
| Oil.....gallons..                    | 150             | 50.00       | .079        | .026    |
| Miscellaneous expenses.....          |                 | 257.62      |             | .136    |
| Subsistence.....                     |                 | 1,320.00    |             | .694    |
| Steamboat expenses.....              |                 | 390.00      |             | .205    |
| Labor.....                           |                 | 3,875.69    |             | 2.039   |
| Supervision.....                     |                 | 621.56      |             | .327    |
| Total field cost.....                |                 | 7,580.95    |             | 3.988   |

## Paving, rock and concrete (950 linear feet or 314 squares).

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$690.02    |             | \$2.198 |
| Stone.....tons..                     | 703             | 1,823.13    | 2.238       | 5.806   |
| Rope, manila.....pounds..            | 2,014           | 614.33      | 2.307       | 1.956   |
| Coal.....tons..                      | 10              | 50.00       | .032        | .159    |
| Oil.....gallons..                    | 100             | 10.00       | .318        | .032    |
| Miscellaneous expenses.....          |                 | 528.96      |             | 1.685   |
| Subsistence.....                     |                 | 405.00      |             | 1.290   |
| Steamboat expenses.....              |                 | 1,900.00    |             | 6.051   |
| Labor.....                           |                 | 1,161.42    |             | 3.689   |
| Supervision.....                     |                 | 224.34      |             | .714    |
| Total field cost.....                |                 | 7,407.20    |             | 23.590  |

## MARENGO BEND (692 R), FOURTH DISTRICT—continued.

*Summary of costs (150 linear feet revetted).*

| Items.                                   | Subaqueous work. |             | Upper bank work.         |             | Grand total. | Total cost per linear foot. |
|------------------------------------------|------------------|-------------|--------------------------|-------------|--------------|-----------------------------|
|                                          | Per square.      | Total.      | Per square. <sup>1</sup> | Total.      |              |                             |
| Total field cost.....                    | \$17.495         | \$15,273.24 | \$7.884                  | \$14,988.15 | \$30,261.39  | \$31.854                    |
| Office expenses.....                     | 1.718            | 1,500.00    | .773                     | 1,469.67    | 2,969.67     | 3.126                       |
| Surveys <sup>2</sup> .....               | .648             | 565.67      | .033                     | 62.85       | 628.52       | .662                        |
| Care of plant <sup>3</sup> .....         | .487             | 425.00      | .221                     | 420.57      | 845.57       | .890                        |
| Repair of plant.....                     | 2.088            | 1,823.00    | .967                     | 1,838.62    | 3,661.62     | 3.854                       |
| Depreciation of plant <sup>4</sup> ..... | .992             | 866.50      | .448                     | 850.43      | 1,716.93     | 1.807                       |
| Totals.....                              | 23.428           | 20,453.41   | 10.326                   | 19,630.29   | 40,083.70    | 42.193                      |

<sup>1</sup> Cost per square completed upper bank work.

<sup>2</sup> This item includes actual cost of survey work done on this revetment.

<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.

<sup>4</sup> Depreciation in to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls. In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Natchez front.*—No construction work was done during the year. The expenditures amounting to \$3,100.12 were for surveys, material, and share of care, repair, and maintenance of plant belonging to the revetment works in the district.

The total field costs for Giles Bend, Marengo Bend, and Natchez front amounted to \$83.845 and the actual money expended \$102,287.47, the difference being due to materials purchased and paid for and now on hand.

*Condition at end of fiscal year.*—In Giles Bend a total of 20,917 linear feet of bank revetment has been placed, consisting of spur dikes, brush mattresses from 300 to 500 feet wide, with upper bank protection of stone and concrete for 17,340 linear feet.

A spur levee 16,621 feet long has been completed to commission grade on the axis of Cowpen Point.

The work has been successful in preventing the threatened cut-off between Giles and Cowpen Bends, although numerous failures of the revetment have occurred, principally along the middle and lower ends.

Some additional repairs are required but generally the work is in good condition.

In Marengo Bend the bank has been protected for 12,844 linear feet consisting of brush mattresses from 300 to 500 feet wide for the subaqueous work and stone and concrete for upper bank protection. Several caves during 1916 and 1917 high waters destroyed or badly damaged portions of the revetment and it is estimated that repairs will be required covering about 3,000 linear feet of revetment. The remainder of the revetment appears to be in fairly good condition.

On the Natchez front the bank has been protected for 3,536 linear feet in two detached pieces, upper 2,136 feet long and lower 1,400 feet long, separated by an unprotected gap of about 1,600 feet.

The work consists of mats 300 feet wide with upper bank protection of rock where found necessary. The work has been successful in preventing further recession of the bank on the harbor front.

The project for improving the harbors at Natchez and Vidalia, Miss. and La., has not been completed. Further extensions of the work in Marengo Bend and along the Natchez front will likely be required from time to time. The project is about 80 per cent completed.

The total expenditures on existing project to end of fiscal year in Giles Bend were \$1,296,587.54 for new work and \$475,829.70 for maintenance, making a total of \$1,772,417.24; in Marengo Bend \$381,857 for new work and \$130,310.50 for maintenance, making a total of \$512,167.50; on the Natchez front \$120,730.26 for new work and \$8,558.34 for maintenance, making a total of \$129,588.60.

*Local cooperation.*—None.

*Terminal facilities.*—Consist of a good landing place for steamboats plying on the Mississippi River, and an incline railroad for transfer of freight to the landing place. These facilities are considered adequate for existing commerce.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river, to preserve generally the controlling levee line, to prevent a cut-off between Giles and Cowpen Bends, and to preserve the harbor front and waterworks of the city of Natchez.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$2,414,173.34;

|             |                |
|-------------|----------------|
| New work    | \$1,799,174.80 |
| Maintenance | 614,998.54     |

|                    |              |
|--------------------|--------------|
| Net total expended | 2,414,173.34 |
|--------------------|--------------|

|                                       |                |
|---------------------------------------|----------------|
| Total appropriations to June 30, 1918 | 1,2,495,527.57 |
|---------------------------------------|----------------|

| Fiscal year ending June 30.                 | 1914         | 1915       | 1916        | 1917         | 1918         |
|---------------------------------------------|--------------|------------|-------------|--------------|--------------|
| Expended for new work <sup>2</sup> .....    | \$322,165.54 | \$8,373.42 | \$57,485.66 | .....        | .....        |
| Expended for maintenance <sup>2</sup> ..... | 17,153.63    | 56,133.10  | 78,590.61   | \$163,066.76 | \$102,287.47 |
| Total expended <sup>2</sup> .....           | 339,319.17   | 64,506.52  | 136,076.27  | 163,066.76   | 102,287.47   |
| Appropriated or allotted.....               | 67,000.00    | 183,000.00 | 200,000.00  | 77,022.57    | .....        |

|                                                                |              |
|----------------------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                               | \$106,614.13 |
| Amount appropriated by sundry civil act approved June 12, 1917 | 97,022.57    |

|                                                 |            |
|-------------------------------------------------|------------|
|                                                 | 203,636.70 |
| Deduction on account of transfer to "Bondurant" | 20,000.00  |

|                                                                                |            |
|--------------------------------------------------------------------------------|------------|
|                                                                                | 183,636.70 |
| June 30, 1918, amount expended during fiscal year <sup>2</sup> for maintenance | 102,287.47 |

|                                       |           |
|---------------------------------------|-----------|
| July 1, 1918, balance unexpended      | 81,349.23 |
| July 1, 1918, outstanding liabilities | 13,058.25 |

|                                                 |           |
|-------------------------------------------------|-----------|
| July 1, 1918, balance available for maintenance | 68,290.98 |
|-------------------------------------------------|-----------|

|                                                       |           |
|-------------------------------------------------------|-----------|
| Amount available for fiscal year ending June 30, 1919 | 68,290.98 |
|-------------------------------------------------------|-----------|

|                                                                                    |                             |
|------------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing projects | <sup>3</sup> Indeterminate. |
|------------------------------------------------------------------------------------|-----------------------------|

|                                                                            |                             |
|----------------------------------------------------------------------------|-----------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920 | <sup>3</sup> Indeterminate. |
|----------------------------------------------------------------------------|-----------------------------|

<sup>1</sup> Total amount, \$2,515,527.57; \$200,000 transferred to "Bondurant."

<sup>2</sup> Not deducting receipts from sales, etc.

<sup>3</sup> Exclusive of available funds.

(c) *Junction of the Mississippi, Red, and Atchafalaya Rivers.*

*Location and description.*—Seven hundred and sixty-four miles below Cairo, right bank.

*Original condition.*—Prior to 1831, the Red River entered the Mississippi and the Atchafalaya flowed out from the Mississippi near the apex of a long horseshoe-shaped bend. In 1831 the Shreve cut-off was made across the narrow part of the peninsula forming the interior of the horseshoe bend, and left the mouth of Red and head of the Atchafalaya in a lake with a precarious and uncertain connection with the Mississippi River. In the course of time the entrance to and channel through this lake, known as Old River, became greatly obstructed during low water by sand bars and shoals. In addition to this, the channel of the Atchafalaya, forced to carry all of Red River, augmented during floods in the Mississippi by water from the latter stream, commenced to enlarge with great rapidity, until there was an apprehension that the Mississippi would desert its present channel and flow to the Gulf of Mexico via the Atchafalaya.

*Previous projects.*—The project adopted by act of June 18, 1878, provided for maintaining a navigable channel during low water between the Mississippi, Red, and Atchafalaya by means of dredging and washing the channel with tugboats and a stern-wheel steamboat. The act of August 2, 1882, transferred the supervision of the work to the Mississippi River Commission. The modified project adopted in 1896-97, provided for the construction of six low relief dams across the Atchafalaya near Simmsport, La., to prevent the further enlargement of that stream; the construction of a dam across Old River between the mouth of Red and head of the Atchafalaya; the reopening of a channel to the Mississippi River by way of upper Old River, and the maintenance of navigation during low water by dredging. In 1897 this project was modified to provide only for the maintenance of navigation by dredging, and for maintenance of the sill dams already built, Nos. 1 and 3. Prior to 1897, the dam across Old River had been destroyed; first by making a cut through it, and, subsequently, by the current of the river.

*Existing project.*—The present project, adopted in 1897 by the Mississippi River Commission, provides for the securing of low-water navigation between the Mississippi, Red, and Atchafalaya Rivers by dredging; the maintenance of sill dams Nos. 1 and 3 in the Atchafalaya; and to repair, care for, and improve the hydraulic dredge, *The Ram*, belonging to the work.

*Operations and results during fiscal year.*—The subproject for this work was to do such dredging as might be necessary to maintain low-water navigation between the Mississippi, Red, and Atchafalaya Rivers through lower Old River, to repair and maintain the sill dams in the Atchafalaya, and to repair and care for the hydraulic dredge, *The Ram*; all work was done by day labor and Government-owned plant.

The river having fallen to a stage of 21 on the Red River Landing gauge, and there being but 13.5 feet of water in the channel over the bar at the entrance to Old River, dredging by the hydraulic dredge *The Ram* was commenced July 30, 1917, and continued until October 16, 1917, operated by a double crew. On this last date a serious breakdown of the main pumping engines put *The Ram* out of service.

She was replaced for a short time by one of the large Mississippi River Commission dredges. Navigation was not obstructed during the year. The lowest reading of the Red River Landing gauge was 4.1. The total length of the channel dredged was about 1,450 feet and the total amount of sand pumped was about 147,398 cubic yards. Later on in the spring of 1918 *The Ram* was operated in pumping sand and gravel for the manufacture of concrete ballast.

So far as known, the sill dams in the Atchafalaya remain in good condition. The usual hydrographic survey of the Mississippi in the vicinity of the mouth of Red River, of lower Old River, and over the sill dams in the Atchafalaya has been made. Changes at the sill dams have been slight and unimportant and in the direction of fill. In Old River there is a continuance of the enlargement noted in previous years.

The field work was in charge of Asst. Engineer H. S. Douglas.

The amount expended from July 1, 1917, to June 30, 1918, is \$12,220.42, distributed as follows:

|                            |                  |
|----------------------------|------------------|
| Dredging-----              | \$5,048.40       |
| Surveys-----               | 1,543.11         |
| Repairs to plant-----      | 4,216.00         |
| Overhead-----              | 581.84           |
| Miscellaneous-----         | 831.07           |
| <b>Total-----</b>          | <b>12,220.42</b> |
| Depreciation of plant----- | 757.00           |
| <b>Gross total-----</b>    | <b>12,977.42</b> |

*Condition at end of fiscal year.*—The work consists of two large brush and stone sill dams in the Atchafalaya to restrict its outlet capacity, and the maintenance by dredging of low-water navigation between the Mississippi, Red, and Atchafalaya Rivers. The work has been successful, and the sill dams, so far as is known, are in good condition. The work is not susceptible of permanent completion, as annual dredging at low water is necessary to remove the deposits made during high water. The sill dams will have to be maintained.

Total expenditures on existing project were \$672,332.35 for new work, and \$620,452.58 for maintenance, making a total of \$1,292,784.93. The project is not susceptible of completion.

*Local cooperation.*—Prior to the United States assuming charge of this work in 1878, the State of Louisiana had endeavored to maintain navigation. Owing to lapse of time, the amount expended by the State is unobtainable.

*Terminal facilities.*—None.

*Effect of improvement.*—Low-water navigation between the Mississippi, Red, and Atchafalaya has been maintained, and the further enlargement of the Atchafalaya has been prevented.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$1,292,784.93:

|                                                   |                                  |
|---------------------------------------------------|----------------------------------|
| New work-----                                     | \$672,332.35                     |
| Maintenance-----                                  | 620,452.58                       |
| <b>Net total expended-----</b>                    | <b>1,292,784.93</b>              |
| <b>Total appropriations to June 30, 1918-----</b> | <b><sup>1</sup> 1,296,228.87</b> |

| Fiscal year ending June 30.                 | 1914             | 1915             | 1916             | 1917             | 1918             |
|---------------------------------------------|------------------|------------------|------------------|------------------|------------------|
| Expended for new work.....                  |                  |                  |                  |                  |                  |
| Expended for maintenance <sup>2</sup> ..... | \$7,668.23       | \$5,990.72       | \$34,731.15      | \$21,977.32      | \$11,514.46      |
| <b>Totalexpended <sup>2</sup>.....</b>      | <b>7,668.23</b>  | <b>5,990.72</b>  | <b>34,731.15</b> | <b>21,977.32</b> | <b>11,514.46</b> |
| <b>Appropriated or allotted.....</b>        | <b>25,000.00</b> | <b>20,000.00</b> | <b>14,832.85</b> | <b>15,705.96</b> |                  |

<sup>1</sup> Total amount \$1,296,495.96; \$167.15 transferred to first and second Mississippi River districts.

<sup>2</sup> Not deducting receipts from sales, etc.

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended.....                                                  | \$223.49                    |
| Amount appropriated by sundry civil act approved June 12, 1917..                       | 15,705.96                   |
| Receipts from sales, etc., during fiscal year 1918.....                                | 2.00                        |
|                                                                                        | 15,931.45                   |
| Deduction on account of transfer to first and second Mississippi River district.....   | 167.15                      |
|                                                                                        | 15,764.30                   |
| June 30, 1918, amount expended during fiscal year for maintenance <sup>1</sup> ..      | 12,220.42                   |
| July 1, 1918, balance unexpended.....                                                  | 3,543.88                    |
| July 1, 1918, outstanding liabilities.....                                             | 662.27                      |
| July 1, 1918, balance available for maintenance.....                                   | 2,881.61                    |
| Amount available for fiscal year ending June 30, 1919.....                             | 2,887.61                    |
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920.....        | <sup>2</sup> Indeterminate. |

(f) *Grand Bay.*

*Location and description.*—Eight hundred and eight miles below Cairo, right bank.

*Original condition.*—Caving of the river banks at this locality had been in progress for many years, but the exact date is unknown. Within recent years caving became more and more active until the dikes (levees) across the lower end of False River were threatened. The destruction of these dikes would have probably entailed the building of a long and costly line of levee around False River and the abandonment to overflow of a large area of cultivated land.

*Previous projects.*—None.

*Existing projects.*—The project adopted August 21, 1916, provides for the protection of the caving bank for a distance of about 10,000 linear feet with mattresses 400 feet wide of brush and stone, the upper bank to be graded to a slope of at least 1 in 4 and paved with rock to the top of the bank.

*Operation and results during fiscal year.*—The work projected was to extend the existing revetment about 3,000 linear feet downstream, make necessary repairs and widen the mattress revetment where scour along the channel edge of the mattresses made additional protection imperative. The work was prosecuted by day labor with Government-owned plant. Mattress construction was commenced November 15, 1917, and all work practicable at the time, was completed on February 20, 1918. The most important work undertaken was the repair of the cave from section 7 to 8, about 400 feet in length. The mattresses sunk were 400 feet wide and comprised 1,883 squares covering 430 linear feet of bank. The upper bank was graded and paved with concrete over an area of 280 squares, covering 430 linear feet of bank. Near the upper end of the revetment additional mattresses were sunk to widen the existing revetment where scour had occurred outside the existing revetment. In all 1,200 squares of mattress covering 600 linear feet of bank were sunk in widening the revetment. An order to build and deliver 3,600 squares of mattress for work at the head of South Pass coming at a time when labor was unusually scarce compelled a suspension of work at Grand Bay and by the time these mattresses were completed the river had risen so that it was impracticable to do further work at Grand Bay during the season.

All of the work was done for the maintenance of existing revetment, a total of 3,082 squares of mattresses and 280 squares of concrete pavement were placed, covering 1,040 linear feet of bank. The total cost of the work was \$52,293.64 for maintenance. The field cost amounted to \$47,444.67 and the actual money expended was \$65,540.18, the difference being due to credits for material on hand. The detailed cost is set forth in the accompanying tables.

<sup>1</sup> Not deducting receipts from sales, etc.<sup>2</sup> Exclusive of available funds.

## GRAND BAY (808 R), FOURTH DISTRICT.

*Mattresses, total area, 3,081 squares.*

## BUILDING MATS.

| Items.                      | Quantity used.  |             | Per square. |         |
|-----------------------------|-----------------|-------------|-------------|---------|
|                             | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Lumber.....foot..           | 154,086         | \$2,249.67  | 50.011      | \$0.730 |
| Wire, No. 10.....pounds..   | 2,034           | 76.27       | .660        | .025    |
| Nails, wire.....            | 19,415          | 708.78      | 6.301       | .230    |
| Treenails.....number        | 30,508          | 72.23       | 9.902       | .023    |
| Brush and poles.....cord..  | 3,211           | 9,230.01    | 1.042       | 2.995   |
| Coal.....tons..             | 5               | 30.00       | .002        | .009    |
| Oil.....                    |                 | 27.33       |             | .009    |
| Miscellaneous expenses..... |                 | 504.51      |             | .163    |
| Subsistence.....            |                 | 3,626.40    |             | 1.112   |
| Steamboat expenses.....     |                 | 728.00      |             | .236    |
| Labor.....                  |                 | 6,024.79    |             | 1.955   |
| Supervision.....            |                 | 253.66      |             | .082    |
| Total field cost.....       |                 | 23,531.65   |             |         |

## BALLASTING AND SINKING.

|                                      |          |           |       |         |
|--------------------------------------|----------|-----------|-------|---------|
| Mobilization and demobilization..... |          | \$193.00  |       |         |
| ¾-inch strand.....pounds..           | 600      | 57.00     | 0.194 | \$0.018 |
| Lumber.....foot..                    | 4,000    | 58.60     | 1.298 | .019    |
| Wire, No. 10.....pounds..            | 1,500    | 65.70     | .487  | .021    |
| Nails, wire.....                     | 3,000    | 113.25    | .973  | .037    |
| Clips, ½-inch.....number..           | 20       | 6.60      | .006  | .002    |
| Stone.....tons..                     | 2,786.27 | 5,989.87  | .904  | 1.944   |
| Rope, manila.....pounds..            | 11,121   | 3,447.69  | 3.609 | 1.119   |
| Miscellaneous expenses.....          |          | 763.17    |       | .247    |
| Subsistence.....                     |          | 1,068.74  |       | .347    |
| Steamboat expenses.....              |          | 1,723.00  |       | .559    |
| Labor.....                           |          | 2,492.50  |       | .809    |
| Supervision.....                     |          | 250.00    |       | .082    |
| Total field cost.....                |          | 16,229.12 |       |         |

## GRADING (280 SQUARES).

|                         |  |            |  |         |
|-------------------------|--|------------|--|---------|
| Subsistence.....        |  | \$1,346.84 |  | \$4.800 |
| Steamboat expenses..... |  | 380.00     |  | 1.360   |
| Labor.....              |  | 3,429.52   |  | 12.250  |
| Supervision.....        |  | 168.00     |  | .600    |
| Total field cost.....   |  | 5,324.36   |  |         |

## PAVING, ROCK AND CONCRETE (280 SQUARES).

|                                   |     |          |       |         |
|-----------------------------------|-----|----------|-------|---------|
| Cement.....sacks..                | 900 | \$447.00 | 3.214 | \$1.704 |
| Sand and gravel.....cubic yards.. | 349 | 293.00   | 1.246 | 1.047   |
| Subsistence.....                  |     | 188.99   |       | .675    |
| Steamboat expenses.....           |     | 429.00   |       | 1.532   |
| Labor.....                        |     | 916.55   |       | 3.273   |
| Supervision.....                  |     | 55.00    |       | .197    |
| Total field cost.....             |     | 2,359.54 |       |         |

GRAND BAY (808 R), FOURTH DISTRICT—continued.

*Summary of costs (1,030 linear feet revetted).*

|                                          | Subaqueous work. |                  | Upper bank work.         |                  | Grand total.     | Total cost <sup>1</sup> per linear foot. |
|------------------------------------------|------------------|------------------|--------------------------|------------------|------------------|------------------------------------------|
|                                          | Per square.      | Total.           | Per square. <sup>1</sup> | Total.           |                  |                                          |
| Total field costs.....                   | \$12.935         | \$39,760.77      | \$27.09                  | \$7,683.90       | \$47,444.67      | \$46.062                                 |
| Office expenses.....                     | 1.292            | 3,981.96         | 3.096                    | 867.01           | 4,848.97         | 4.707                                    |
| Surveys <sup>2</sup> .....               | .110             | 339.39           | .264                     | 73.89            | 413.28           | .401                                     |
| Care of plant <sup>3</sup> .....         | .337             | 1,038.00         | .717                     | 221.01           | 1,264.03         | 1.227                                    |
| Repair of plant.....                     | 1.431            | 4,409.67         | 3.429                    | 960.16           | 5,369.83         | 5.213                                    |
| Depreciation of plant <sup>4</sup> ..... | .919             | 2,832.01         | 2.192                    | 613.79           | 3,445.80         | 3.345                                    |
| <b>Total.....</b>                        |                  | <b>52,361.80</b> |                          | <b>10,419.76</b> | <b>62,786.58</b> |                                          |

<sup>1</sup> Cost per square completed upper bank work.<sup>2</sup> This item includes actual cost of survey work done on this revetment.<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>4</sup> Depreciation in to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of fiscal year.*—A total of 3,180 linear feet of bank is revetted with mattresses 400 feet wide, and a pavement of rock and concrete extending to the top of the bank. Over the stretch thus protected the bank has been made reasonably permanent and the dikes across Grand Bay and Hermitage (lower end of False River) preserved. So far as is known at this time the work is in good condition. The project is about 40 per cent completed. The total expenditures on existing project were \$142,565.51 for new work and \$65,540.18 for maintenance, making a total of \$208,105.69.

*Local cooperation.*—None.*Terminal facilities.*—None.*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate and deepen the channel, to protect the banks of the river and preserve the dikes across the lower end of False River.*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.*Recommended modifications of project.*—None.*References to published articles not previously reported.*—None.*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$208,105.69:

|                  |              |
|------------------|--------------|
| New work.....    | \$142,565.51 |
| Maintenance..... | 65,540.18    |

|                         |            |
|-------------------------|------------|
| Net total expended..... | 208,105.69 |
|-------------------------|------------|

|                                            |            |
|--------------------------------------------|------------|
| Total appropriations to June 30, 1918..... | 323,671.62 |
|--------------------------------------------|------------|

| Fiscal year ending June 30.                 | 1914 | 1915 | 1916 | 1917              | 1918             |
|---------------------------------------------|------|------|------|-------------------|------------------|
| Expended for new work <sup>1</sup> .....    |      |      |      | \$142,565.51      |                  |
| Expended for maintenance <sup>1</sup> ..... |      |      |      |                   | \$65,540.18      |
| <b>Total expended<sup>1</sup>.....</b>      |      |      |      | <b>142,565.51</b> | <b>65,540.18</b> |
| Appropriated or allotted.....               |      |      |      | 175,000.00        | 150,671.62       |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended-----                                                  | \$32, 434. 49               |
| Amount appropriated by sundry civil act approved June 12, 1917-----                    | 150, 671. 62                |
|                                                                                        | 183, 106. 11                |
| June 30, 1918, amount expended during fiscal year <sup>1</sup> for maintenance-----    | 65, 540. 18                 |
| July 1, 1918, balance unexpended-----                                                  | 117, 565. 93                |
| July 1, 1918, outstanding liabilities covered by uncompleted contracts-----            | 137. 10                     |
| July 1, 1918, balance available for maintenance-----                                   | 117, 428. 83                |
| Amount available for fiscal year ending June 30, 1919-----                             | 117, 428. 83                |
| Amount (estimated) required to be appropriated for completion of existing project----- | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920-----        | <sup>2</sup> Indeterminate. |

(g) *Plaquemine, La.*

*Location and description.*—Eight hundred and fifty-four miles below Cairo, right bank.

*Original condition.*—Caving in this bend has been in progress from an early date, probably for 100 years or more, but the exact date is unknown. The caving has destroyed a considerable portion of the town of Plaquemine, together with several lines of levee and threatened the Government lock at the head of Bayou Plaquemine. The bend was peculiar, inasmuch as caves or subsidence of enormous extent occurred at intervals without warning.

*Previous projects.*—The work originated under the river and harbor act of August 11, 1888, which provided for "securing a navigable channel 60 feet wide and 6 feet in depth, from deep water up to Plaquemine Dike, and for securing the mouth of the bayou from further caving." The project provided for the construction of four submerged sloping spur dikes of brush and stone, placed at intervals of about 1,000 feet. In 1893, the project was modified to provide for continuous revetment of the bank with mattresses of willow brush. Up to 1902, five spur dikes had been constructed and the intervals between extensively matted, at a cost of \$258,516.22. Operations were suspended until 1911, when the Mississippi River Commission assumed charge of the work.

*Existing project.*—The project adopted in 1911 provides for a continuous standard revetment of the bank in front of the Government lock and the town of Plaquemine with mattresses 400 feet wide, together with upper-bank grading and paving.

*Operations and results during fiscal year.*—The projected work for the past season was to restore the upper end of the work which had been destroyed by a franking cave, and to make extensive repairs to the revetment in the vicinity of the Government lock. The work was prosecuted by day labor with Government-owned plant. Mattress construction was commenced August 23, 1917, and all work practicable with the funds available was completed November 24, 1917. In all 10,900 squares of mattress, covering 2,980 linear feet of bank, were sunk, nearly all of the mattresses being 400 feet wide. The upper bank was graded and paved over an area of 1,029 squares covering a distance of 1,250 linear feet. The upper end of the revetment has been entirely restored for a distance of 650 feet; a cave near section 43 has been repaired for a length of 570 feet; and from a point about 200 feet above section 46 to below section 50, a distance of 1,760 feet, repair work has been continuous. Before the work here outlined had been completed the allotment for this locality was exhausted and operations were suspended.

All of the work was done for the maintenance of existing revetment. A total of 10,900 squares of mattress were placed, covering 2,980 linear feet of bank, and the upper bank was graded and paved over 1,029 squares, covering a distance of 1,250 linear feet.

The total cost of the work done was \$101,670.02 for maintenance. The field cost amounted to \$100,683.89, and the actual money expended \$75,793.79, the difference being due to credits for material on hand and purchased and paid for from allotment for general repairs and stone. The detailed cost of this work is set forth in the accompanying tables.

<sup>1</sup> Not deducting receipts from sales, etc.<sup>2</sup> Exclusive of available funds.

## PLAQUEMINE, LA., REVETMENT (854 R.), FOURTH DISTRICT.

*Mattresses, total area, 10,748 squares.*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$560.64    |             | \$0.052 |
| Lumber.....feet.....                 | 542.430         | 7,944.86    | 50.468      | .738    |
| Wire, No. 10.....pounds.....         | 7.094           | 266.02      | .660        | .025    |
| Nails, wire.....                     | 73.519          | 2,212.32    | 6.840       | .205    |
| Treenails.....number.....            | 106.400         | 246.66      | 9.898       | .023    |
| Brush and poles.....cords.....       | 11.200          | 19,249.44   | 1.041       | 1.691   |
| Coal.....tons.....                   | 7               | 44.00       | .006        | .004    |
| Oil.....                             |                 | 22.00       |             | .002    |
| Miscellaneous expenses.....          |                 | 456.81      |             | .042    |
| Subsistence.....                     |                 | 5,317.77    |             | .495    |
| Steamboat expenses.....              |                 | 2,968.00    |             | .276    |
| Labor.....                           |                 | 9,462.51    |             | .880    |
| Supervision.....                     |                 | 1,403.66    |             | .130    |
| Total field cost.....                |                 | 50,154.69   |             |         |

## BALLASTING AND SINKING.

|                                            |          |           |       |         |
|--------------------------------------------|----------|-----------|-------|---------|
| Mobilization and demobilization.....       |          | \$524.77  |       | \$0.049 |
| $\frac{3}{8}$ -inch strand.....pounds..... | 1,200    | 114.00    | 0.112 | .0107   |
| Lumber.....feet.....                       | 20,000   | 293.00    | 1.861 | .0273   |
| Wire, No. 10.....pounds.....               | 2,800    | 122.64    | .261  | .0114   |
| Nails, wire.....                           | 4,100    | 151.70    | .381  | .0141   |
| Clips, $\frac{1}{2}$ -inch.....number..... | 40       | 13.20     | .0037 | .0012   |
| Stone.....tons.....                        | 8,179.87 | 17,963.99 | .761  | 1.671   |
| Rope, manila.....pounds.....               | 9,815    | 3,042.69  | .913  | .283    |
| Coal.....tons.....                         | 8        | 48.00     |       | .004    |
| Oil.....                                   |          | 24.00     |       | .002    |
| Miscellaneous expenses.....                |          | 574.08    |       | .053    |
| Subsistence.....                           |          | 2,926.88  |       | .272    |
| Steamboat expenses.....                    |          | 2,544.00  |       | .237    |
| Labor.....                                 |          | 7,238.07  |       | .673    |
| Supervision.....                           |          | 1,167.00  |       | .109    |
| Total field cost.....                      |          | 36,748.02 |       |         |

*Grading (1,029 squares).*

| Items.                  | Quantity used.  |             | Per square. |         |
|-------------------------|-----------------|-------------|-------------|---------|
|                         | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Subsistence.....        |                 | \$1,029.07  |             | \$1.000 |
| Steamboat expenses..... |                 | 418.00      |             | .406    |
| Labor.....              |                 | 3,593.79    |             | 3.492   |
| Supervision.....        |                 | 554.58      |             | .539    |
| Total field cost.....   |                 | 5,595.44    |             |         |

*Paving, rock and concrete (1,029 squares).*

| Items.                  | Quantity used.  |             | Per square. |         |
|-------------------------|-----------------|-------------|-------------|---------|
|                         | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Stone.....tons.....     | 2,820.47        | \$6,193.75  | 2.741       | \$6.019 |
| Subsistence.....        |                 | 176.27      |             | .171    |
| Steamboat expenses..... |                 | 456.00      |             | .443    |
| Labor.....              |                 | 1,178.39    |             | 1.145   |
| Supervision.....        |                 | 180.57      |             | .175    |
| Total field cost.....   |                 | 8,184.98    |             |         |

*Summary of costs (3,020 linear feet revetted).*

|                                          | Subaqueous work. |              | Upper bank work.         |              | Grand total.  | Total cost per linear foot. |
|------------------------------------------|------------------|--------------|--------------------------|--------------|---------------|-----------------------------|
|                                          | Per square.      | Total.       | Per square. <sup>1</sup> | Total.       |               |                             |
| Total field cost.....                    | \$8. 085         | \$86,902. 71 | \$13. 392                | \$13,780. 42 | \$100,683. 13 | \$33. 334                   |
| Office expenses.....                     | .079             | 851. 82      | .131                     | 135. 07      | 986. 89       | .326                        |
| Surveys <sup>2</sup> .....               | .025             | 267. 00      | .052                     | 53. 84       | 320. 84       | .106                        |
| Care of plant <sup>3</sup> .....         | .500             | 5,361. 00    | .826                     | 850. 11      | 6,211. 11     | 2. 056                      |
| Repair of plant.....                     | .120             | 1,278. 54    | .186                     | 191. 35      | 1,469. 89     | .4860                       |
| Depreciation of plant <sup>4</sup> ..... | .320             | 3,440. 44    | .530                     | 545. 56      | 3,986. 00     | 1. 320                      |
| Total.....                               |                  | 98,101. 51   |                          | 15,556. 35   | 113,657. 86   |                             |

<sup>1</sup> Cost per square completed upper bank work.<sup>2</sup> This item includes actual cost of survey work done on this revetment.<sup>3</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>4</sup> Depreciation in to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 5 per cent for all plant with treated (creosoted) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

*Condition at end of fiscal year.*—This revetment is 6,370 feet long. The upper bank has caved in several places and the subaqueous bank in many more. The Government lock and much of the town of Plaquemine have so far been preserved. The most essential repairs have been made, but other extensive repairs are still needed.

The total expenditure on the existing project has been \$189,688.32 for new work and \$114,490.65 for maintenance, making a total of \$304,178.97.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel, to protect the banks of the river, and to preserve the Government lock and the town of Plaquemine, La.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$304,178.97:

|                  |               |
|------------------|---------------|
| New work.....    | \$189,688. 32 |
| Maintenance..... | 114,490. 65   |

|                         |             |
|-------------------------|-------------|
| Net total expended..... | 304,178. 97 |
|-------------------------|-------------|

|                                            |             |
|--------------------------------------------|-------------|
| Total appropriations to June 30, 1918..... | 304,178. 97 |
|--------------------------------------------|-------------|

| Fiscal year ending June 30.                 | 1914         | 1915         | 1916         | 1917        | 1918         |
|---------------------------------------------|--------------|--------------|--------------|-------------|--------------|
| Expended for new work <sup>2</sup> .....    | \$35,738. 53 | \$33,639. 83 | \$26,566. 92 |             |              |
| Expended for maintenance <sup>2</sup> ..... |              | 7,897. 59    | 24,590. 33   | \$1,859. 85 | \$75,793. 79 |
| Total expended <sup>2</sup> .....           | 35,738. 53   | 41,537. 42   | 51,157. 25   | 1,859. 85   | 75,793. 79   |
| Appropriated or allotted.....               | 50,000. 00   | 28,385. 18   |              | 75,793. 79  |              |

<sup>1</sup> Total amount, \$305,793.79; \$1,614.82 transferred to first and second Mississippi River district.

<sup>2</sup> Not deducting receipts from sales, etc.

|                                                                                           |                             |
|-------------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended-----                                                     | \$1,614.82                  |
| Amount appropriated by sundry civil act approved June 12, 1917----                        | 75,793.79                   |
|                                                                                           | 77,408.61                   |
| Deduction on account of transfer to first and second Mississippi<br>River district-----   | 1,614.82                    |
|                                                                                           | 75,793.79                   |
| June 30, 1918, amount expended during fiscal year <sup>1</sup> for maintenance--          | 75,793.79                   |
| Amount (estimated) required to be appropriated for completion of<br>existing project----- | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June<br>30, 1920-----        | <sup>2</sup> Indeterminate. |

*(h) Harbor at New Orleans, La.*

*Location and description.*—Nine hundred and sixty-five miles below Cairo, right and left banks.

*Original condition.*—As far back as authentic records exist, the river banks in the concave bends of the river comprised in New Orleans Harbor have been caving, destroying wharves, levees, railroad terminals, and other works of public improvement, thus obstructing commerce.

*Previous projects.*—In 1878 a mixed board of Army and civil engineers was convened to examine and report on the means necessary to protect the wharves and harbor from the incursions of the river. By act of June 18, 1878, Congress made an appropriation to begin the work. The approved project contemplated the protection of the caving banks in the third district reach with mattresses constructed of fish-pole cane. Work was prosecuted until September 29, 1881, when the project was definitely abandoned, after an expenditure of \$114,564.72.

*Existing project.*—The act of August 2, 1882, placed the work under the supervision of the Mississippi River Commission, which, on September 18, 1882, adopted a project providing for the protection of the caving bank in the Carrollton Bend with continuous mattresses of willow brush. In 1884 the project was modified to provide, in addition, for submerged sloping spur dykes of brush and stone, and the scope of the work was extended to cover the Gouldsboro Bend. In 1889 the work was extended to cover the Greenville Bend and the third district reach. The present project, as modified, provides for both spur dikes and continuous mattress revetment.

*Operations and results during fiscal year.*—The projected work for the past year was to continue revetment work in the Greenville Bend, to repair the work in the Gouldsboro and Carrollton Bends, and the third district reach. Because of delays incident to construction and delivering 3,600 squares of mattress for work at the head of South Pass, revetment work in New Orleans Harbor could not be commenced until the river had risen so that the subsequent progress was necessarily very slow and it was further delayed by unprecedented shortage of labor. Work was prosecuted by day labor with Government owned plant. Mattress construction was commenced February 23, 1918, and sinking of mattresses was commenced April 3, 1918; both were continued until date of this report. The first work undertaken was the widening and extension of the revetment in Carrollton Bend, where the controlling levee is threatened. Here 2,650 squares of mattresses were placed and the revetment extended upstream 400 linear feet. In the third district reach 3,200 squares of mattresses were placed, prolonging the finished revetment downstream 750 linear feet.

A considerable portion of the work, consisting of 1,450 squares of mattress, covering 590 linear feet of bank, was for the maintenance of existing revetment; the remainder, 4,400 squares, covering 1,035 linear feet, was new work. In all 6,150 squares of mattress, covering 1,625 linear feet of bank, was placed. The total cost of the work was \$95,580.29, of which \$60,865.25 was for new work and \$34,714.94 for maintenance. The field cost amounted to \$87,437.08 and the actual money expended was \$79,597.60 of which \$50,687.60 was expended for new work and \$28,910 for maintenance, the difference being due to credits for material on hand and purchased and paid for and now on hand. The detailed cost is set forth in the accompanying tables.

<sup>1</sup> Not deducting receipts from sales, etc.<sup>2</sup> Exclusive of available funds.

## HARBOR AT NEW ORLEANS, LA., (965 R. AND L.), FOURTH DISTRICT.

*Mattresses, total area 6,450 squares.*

## BUILDING MATS.

| Items.                               | Quantity used.  |             | Per square. |         |
|--------------------------------------|-----------------|-------------|-------------|---------|
|                                      | Total quantity. | Total cost. | Quantity.   | Cost.   |
| Mobilization and demobilization..... |                 | \$1,256.00  |             | \$0.195 |
| Lumber.....foot.....                 | 326,500         | 5,866.63    | 50.620      | .909    |
| Wire No. 10.....pounds.....          | 4,257           | 159.64      | .660        | .024    |
| Nails, wire.....                     | 44,117          | 1,612.31    | 6.839       | .250    |
| Treenails.....                       | 63,855          | 148.03      | 9.900       | .023    |
| Brush and poles.....cord.....        | 6,721           | 20,016.55   | 1.042       | 3.103   |
| Coal.....tons.....                   | 20              | 120.00      |             | .019    |
| Oil.....                             |                 | 55.65       |             | .008    |
| Miscellaneous expenses.....          |                 | 2,599.96    |             | .403    |
| Subsistence.....                     |                 | 4,276.56    |             | .663    |
| Steamboat expenses.....              |                 | 2,296.00    |             | .356    |
| Labor.....                           |                 | 9,101.34    |             | 1.429   |
| Supervision.....                     |                 | 1,761.99    |             | .273    |
| Total field cost.....                |                 | 49,270.66   |             |         |

## BALLASTING AND SINKING.

|                                      |          |           |       |         |
|--------------------------------------|----------|-----------|-------|---------|
| Mobilization and demobilization..... |          | \$602.00  |       | \$0.103 |
| 3/4-inch strand.....pounds.....      | 3,000    | 285.00    | 0.513 | .048    |
| Wire No. 10.....do.....              | 5,000    | 219.50    | .854  | .037    |
| Nails, wire.....                     | 4,700    | 177.36    | .803  | .030    |
| Clips, 1/2-inch.....number.....      | 50       | 16.50     | .008  | .002    |
| Stone.....tons.....                  | 4,427.13 | 8,016.29  | .756  | 1.370   |
| Rope, manila.....pounds.....         | 26,335   | 8,164.00  | 4.502 | 1.395   |
| Coal.....tons.....                   | 25       | 150.00    | .004  | .025    |
| Oil.....                             |          | 72.00     |       | .012    |
| Miscellaneous expenses.....          |          | 1,865.17  |       | .319    |
| Subsistence.....                     |          | 2,656.86  |       | .454    |
| Steamboat expenses.....              |          | 6,934.00  |       | 1.185   |
| Labor.....                           |          | 8,135.18  |       | 1.391   |
| Supervision.....                     |          | 872.56    |       | .149    |
| Total field cost.....                |          | 38,166.42 |       |         |

*Summary of costs (1,626 linear feet revetted).*

|                                          | Subaqueous work. |             | Total cost per linear foot. |
|------------------------------------------|------------------|-------------|-----------------------------|
|                                          | Per square.      | Total.      |                             |
| Total field cost.....                    | \$14.217         | \$87,437.08 | \$53.774                    |
| Office expenses.....                     | 1.324            | 8,143.21    | 5.007                       |
| Surveys <sup>1</sup> .....               | .039             | 244.52      | .150                        |
| Care of plant <sup>2</sup> .....         | .422             | 2,597.00    | 1.597                       |
| Repair of plant.....                     | 1.913            | 11,769.49   | 7.238                       |
| Depreciation of plant <sup>3</sup> ..... | 1.236            | 7,604.89    | 4.677                       |
| Total.....                               |                  | 117,796.19  |                             |

<sup>1</sup> This item includes actual cost of survey work done on this revetment.<sup>2</sup> Includes all costs of looking after and caring for plant when same is out of commission, but does not include the cost of caring for plant when it is temporarily laid up during the working season on account of inclement weather conditions or unfavorable river stages.<sup>3</sup> Depreciation is to be taken at 6 per cent of first cost per annum for all plants with untreated wood hulls; 5 per cent for all plant with treated (creosote) wooden hulls; and 4 per cent for all plant with steel hulls.

In distributing plant charges among the various works there is charged to levees an amount sufficient to represent a fair charge for the service rendered levee work by floating plant.

| Location.           | Expend-<br>ed as per<br>financial<br>state-<br>ment. | Debits to<br>material<br>on hand. | Credited<br>by mate-<br>rial on<br>hand. | Total<br>field<br>cost. | Unit field cost.        |                        | Unit over-<br>head cost. |                        | Work accom-<br>plished. |                 | Total<br>cost of<br>work. | Gross unit<br>cost. <sup>1</sup> |                        | Remarks.                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|------------------------------------------------------|-----------------------------------|------------------------------------------|-------------------------|-------------------------|------------------------|--------------------------|------------------------|-------------------------|-----------------|---------------------------|----------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |                                                      |                                   |                                          |                         | Per<br>square.<br>foot. | Per<br>linear<br>foot. | Per<br>square<br>foot.   | Per<br>linear<br>foot. | Squares. <sup>2</sup>   | Linear<br>feet. |                           | Per<br>square.<br>foot.          | Per<br>linear<br>foot. |                                                                                                                                                                                                                                                                                                                                                                                           |
| Hard Times.....     | \$8,636.37                                           | \$18,113.11                       | \$16,512.84                              | \$5,423.07              |                         |                        |                          |                        |                         |                 | \$7,485.74                |                                  |                        | No work done other than surveys.<br>Pro rata of equipment, etc.,<br>charged. Material belonging to<br>Hard Times to value of \$2,750.88<br>was used by Kempe Bend.                                                                                                                                                                                                                        |
| Bondurant Chute.... | 42,310.97                                            | 4,543.00                          |                                          | 56,412.82               | \$13.074                | \$0.189                | \$0.584                  |                        | 4,315                   | 1,400           | 57,231.16                 | \$13.263                         | \$40.879               | All repair work. Treasury settle-<br>ment of \$6,927.15 for freight on<br>rock was accounted for in last re-<br>port. Bills to value of \$12,886.05<br>for Bondurant Chute were<br>charged to general repairs and<br>stone. Rock to value of \$5,318.29<br>belonging to general repairs and<br>stone used. Rock belonging to<br>Bondurant Chute to value of<br>\$1,000 was used on levee. |
| Kempe Bend.....     | 128,790.23                                           | 13,723.15                         |                                          | 147,715.33              | 8.302                   | .147                   | .608                     |                        | 17,777                  | 3,900           | 150,324.76                | 8.456                            | 38.544                 | Repair work. Rock belonging to<br>general repairs and stone to<br>value of \$5,600.44 used. Material<br>belonging to Hard Times to value<br>of \$2,750.88 used.                                                                                                                                                                                                                           |
| Giles Bend.....     | 52,917.87                                            | 3,894.21                          |                                          | 49,854.97               | 13.402                  | 1.653                  | 7.384                    |                        | 3,720                   | 833             | 56,005.34                 | 15.055                           | 67.223                 | Repair work; \$6,759.20 included in<br>financial statement was spent for<br>maintenance of Cowpen Neck<br>Levee. Rock belonging to gen-<br>eral repairs and stone to value of<br>\$4,683.66 was used for sinking,<br>and rock to value of \$1,278.80 be-<br>longing to Grand Bay was used<br>for sinking.                                                                                 |
| Marengo Bend.....   | 46,269.48                                            | 565.95                            | 15,008.93                                | 30,883.91               | 11.135                  | 1.071                  | 3.126                    |                        | 2,774                   | 950             | 33,859.58                 | 12.206                           | 35.641                 | Rock belonging to general repairs<br>and stone to value of \$2,033.08<br>used.                                                                                                                                                                                                                                                                                                            |
| Natchez Front.....  | 3,100.12                                             |                                   |                                          | 2,388.03                |                         |                        |                          |                        |                         |                 | 3,100.12                  |                                  |                        | No work done other than surveys.<br>Pro rata of equipment, etc.,<br>charged.                                                                                                                                                                                                                                                                                                              |
| Grand Bay.....      | 365,540.18                                           | 323,044.87                        | 28,340.34                                | 47,857.95               | 14.239                  | 1.443                  | 4.707                    |                        | 3,361                   | 1,030           | 52,706.92                 | 15.082                           | 51.171                 |                                                                                                                                                                                                                                                                                                                                                                                           |
| Plaquemine.....     | 75,703.79                                            | 44,194.07                         | 5,941,003.13                             | 7,887                   | 33.44                   | .077                   | .328                     |                        | 12,856                  | 3,020           | 101,990.02                | 7.964                            | 33.771                 |                                                                                                                                                                                                                                                                                                                                                                                           |
| New Orleans, La.... | 579,597.00                                           | 515,583.90                        | 1.46                                     | 87,681.60               | 14.257                  | 1.324                  | 5.008                    |                        | 6,150                   | 1,626           | 95,824.81                 | 15.581                           | 58.932                 |                                                                                                                                                                                                                                                                                                                                                                                           |

<sup>1</sup> Includes every item of field and overhead charges.<sup>2</sup> Squares include both subaqueous and upper bank work.<sup>3</sup> \$7,537.79 due from other districts.<sup>4</sup> \$22,008.10 was expended from the allotment for general repairs and stone.<sup>5</sup> \$639.77 was expended from the allotment for general repairs and stone.

*Condition at end of fiscal year.*—A total of 56,750 linear feet of bank has been protected by continuous mattress revetment, by submerged sloping spur dikes in conjunction with continuous mattresses and by spur dikes alone. Where thus protected, the banks have been rendered reasonably permanent, and the destruction of wharves, railroad inclines, and other commercial facilities has been prevented. About 75 per cent of the project has been completed. There remains about 5,000 linear feet of bank to be revetted and the intervals between the spur dikes in the Gouldsboro Bend require to be covered with continuous mattress. Surveys over completed work indicate that considerable scour has occurred where mattresses were placed, and of the river bed beyond them. While no serious caving has occurred, it is considered to be threatened at several localities.

The total expenditures on existing project were \$2,034,711.18 for new work and \$253,361.07 for maintenance, making a total of \$2,288,072.25.

*Local cooperation.*—The city of New Orleans undertook to protect the bank in the third district reach and expended \$327,417.04 for this purpose. The State of Louisiana through the board of commissioners of the port of New Orleans, has expended \$10,000,000 for the construction of wharves and other terminal facilities. The funds expended were obtained by the sale of bonds and by local taxation.

*Terminal facilities.*—There are 39.5 miles of river frontage in the harbor of New Orleans available for shipping. There are 5 miles of wharves, of which 3.5 miles are covered with steel sheds to protect and store merchandise. The wharves are substantially built of creosoted timber. The public wharves are under the control of the board of commissioners of the port of New Orleans since May, 1901. The physical connection with practically all the water terminals is by means of a belt railroad owned and operated by the city of New Orleans and which generally serves all water terminals, immediately in the rear of the sheds and connects with all railroads. All terminal facilities are open to the public.

*Effect of improvement.*—The effect of the improvement has been to correct, permanently locate, and deepen the channel to protect the banks of the river, and the commercial terminal facilities of the harbor have been rendered reasonably permanent.

*Proposed operations.*—It is proposed to make such repairs as may be necessary to preserve the continuity of the existing revetment, widening it where the channel of the river has destroyed the outer edge of the mats, and making such extensions as the available funds and the supply of labor may permit.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918 after deducting receipts from sales, etc., amounting to \$2,288,072.25:

|                                             |                           |
|---------------------------------------------|---------------------------|
| New work .....                              | \$2,034,711.18            |
| Maintenance .....                           | 253,361.07                |
| Net total expended .....                    | 2,288,072.25              |
| Total appropriations to June 30, 1918 ..... | <sup>1</sup> 2,477,709.16 |

| Fiscal year ending June 30.                 | 1914        | 1915        | 1916        | 1917        | 1918        |
|---------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work <sup>2</sup> .....    | \$42,525.01 | \$59,060.74 | \$42,813.92 | .....       | \$50,687.60 |
| Expended for maintenance <sup>2</sup> ..... | 2,000.00    | 2,827.93    | 12,585.85   | \$22,420.85 | 28,910.00   |
| Total expended <sup>2</sup> .....           | 44,525.01   | 61,888.67   | 55,399.77   | 22,420.85   | 79,597.60   |
| Appropriated or allotted .....              | 50,000.00   | 24,664.91   | 130,000.00  | 150,000.00  | .....       |

<sup>1</sup> Total amount \$2,498,044.25; \$20,335.09 transferred to first and second Mississippi River districts.

<sup>2</sup> Not deducting receipts from sales, etc.

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended.....                                                  | \$132, 267. 57              |
| Amount appropriated by sundry civil act approved June 12, 1917.....                    | 150, 000. 00                |
|                                                                                        | <hr/> 282, 267. 57          |
| Deduction on account of transfer to first and second Mississippi River districts.....  | 20, 335. 09                 |
|                                                                                        | <hr/> 261, 932. 48          |
| June 30, 1918, amount expended during fiscal year <sup>1</sup> —                       |                             |
| For new work.....                                                                      | \$50, 687. 60               |
| For maintenance .....                                                                  | 28, 910. 00                 |
|                                                                                        | <hr/> 79, 597. 60           |
| July 1, 1918, balance unexpended.....                                                  | 182, 334. 88                |
| July 1, 1918, outstanding liabilities.....                                             | 34, 056. 11                 |
|                                                                                        | <hr/>                       |
| July 1, 1918, balance available for maintenance.....                                   | 148, 278. 77                |
| Amount available for fiscal year ending June 30, 1919.....                             | 148, 278. 77                |
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920.....        | <sup>2</sup> Indeterminate. |

(i) *General repairs and stone.*

*Location and description.*—The general character of operations under this allotment renders it impracticable to give data as to location and description.

*Original condition.*—The general character of operations under this allotment renders it impracticable to give data as to original condition.

*Previous projects.*—None.

*Existing project.*—The allotment is intended to cover unforeseen contingencies on the several works throughout the district and the purchase of stone, principally ballast reaching the harbor of New Orleans in vessels engaged in foreign trade.

*Operations and results during fiscal year.*—The diversified character of operations under this allotment renders it impracticable to give data as to location, original condition, previous and present projects, etc.

The allotment is intended to cover unforeseen contingencies on the several works throughout the district and the purchase of stone. The work comes under the general project for improving the Mississippi River. An allotment of \$34,632.37 was made during the present year, and there was a balance on hand of \$18,387.24 from previous allotment.

During the period covered by this report \$45,253.73 has been expended for the operation of the dredge *The Ram* in dredging gravel for making ballast, for the purchase of ships' ballast in New Orleans Harbor, for the making of concrete ballast, for repairs to revetment work at Plaquemine, Kempe Bend, and Bondurant Chute, and for administration.

*Conditions at end of fiscal year.*—The allotment is intended to cover unforeseen contingencies on the works throughout the district and the purchase of stone. The funds allotted were expended for the purpose stated. The total amount expended on the existing project has been \$39,318.27 for new work and \$100,548.22 for works of maintenance.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The allotment has been beneficial to all the revetment work of the district in securing ballast at bargain prices.

*Proposed operations.*—Purchase of stone, manufacture of ballast, and emergency repair work.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

<sup>1</sup> Not deducting receipts from sales, etc.<sup>2</sup> Exclusive of available funds.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$139,866.49:

New work.....\$39,318.27  
Maintenance.....100,548.22

Net total expended.....139,866.49

Total appropriations to June 30, 1918.....<sup>1</sup>143,059.19

| Fiscal year ending June 30.                 | 1914        | 1915        | 1916        | 1917        | 1918        |
|---------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work <sup>2</sup> .....    | \$12,099.56 | \$15,175.65 | \$12,043.06 |             |             |
| Expended for maintenance <sup>2</sup> ..... | 4,941.96    | 1,028.13    |             | \$24,418.05 |             |
| Total expended <sup>2</sup> .....           | 17,041.52   | 16,203.78   | 12,043.06   | 24,418.05   | \$45,253.73 |
| Appropriated or allotted.....               | 20,000.00   | 20,425.82   | 23,000.00   | 34,632.37   |             |

July 1, 1917, balance unexpended.....\$18,387.24

Amount appropriated by sundry civil act approved June 12, 1917.. 34,632.37

53,019.61

Deduction on account of transfer to first and second Mississippi River districts.....4,574.18

48,445.43

June 30, 1918, amount expended during fiscal year<sup>1</sup> for maintenance 45,253.73

July 1, 1918, balance unexpended.....3,191.70

July 1, 1918, outstanding liabilities.....46.75

July 1, 1918, balance available for maintenance.....3,144.95

Amount available for fiscal year ending June 30, 1919.....3,144.95

Amount (estimated) required to be appropriated for completion of existing project.....<sup>3</sup>Indeterminate.

Amount that can be profitably expended in fiscal year ending June 30, 1920.....<sup>3</sup>Indeterminate.

## II. LEVEES.

*General.*—All levees are being constructed to the grade and section fixed by the Mississippi River Commission by resolution adopted April, 1914, which provides that the grade shall be 3 feet above the deduced confined flood of 1912, with section having a crown 8 feet wide, river slope 3 to 1, land slope 3 to 1 to from 5 to 8 below crown, and thence a banquette of width from 20 to 40 feet, dependent on the height of the levee, with back slope of 4 to 1.

*Summary of present condition of levee system.*

| Name of district.  | Total miles in system. | Levees up to grade and section June 30, 1918. | Yardage required to complete. | Yardage new levees needed in next 5 years. | Total.     |
|--------------------|------------------------|-----------------------------------------------|-------------------------------|--------------------------------------------|------------|
| Lower Tensas.....  | 157.50                 | 16.67                                         | 12,141,824                    | 3,131,500                                  | 15,273,324 |
| Atchafalaya.....   | 127.40                 | 18.00                                         | 12,500,000                    | 1,150,000                                  | 13,650,000 |
| Lafourche.....     | 82.30                  | 20.06                                         | 2,871,285                     | 1,450,000                                  | 4,321,285  |
| Barataria.....     | 71.15                  | 38.43                                         | 843,201                       | 294,422                                    | 1,137,623  |
| Pontchartrain..... | 125.35                 | 18.90                                         | 8,463,358                     | 816,342                                    | 9,279,700  |
| Lake Borgne.....   | 78.13                  | 47.92                                         | 626,369                       | 212,416                                    | 838,785    |
| Total.....         | 641.83                 | 159.98                                        | 37,446,037                    | 7,054,680                                  | 44,500,717 |

<sup>1</sup> Total amount, \$147,632.37; \$4,574.18 transferred to first and second Mississippi River districts.

<sup>2</sup> Not deducting receipts from sales, etc.

<sup>3</sup> Exclusive of available funds.

*(a) Lower Tensas levee district.*

*Location and description.*—The lower Tensas levee district extends on right bank, in continuation of the upper Tensas levee district, from a point opposite Warrenton, Miss., 607 miles below Cairo, to the mouth of Red River, 764 miles below Cairo, with a river frontage of 157 miles and an area of 2,080 square miles. The levee line is continuous from the upper end of the district down to Point Breeze, 755 miles below Cairo. The total length of levee line is 157.40 miles, of which 150.45 miles have been built.

*Original condition.*—Originally, there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, and slope one on three, to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, 565,189.98 cubic yards, at a total cost of \$123,304.25.

The total work done by the United States and local authorities is as follows:

|                                                   |               |                       |
|---------------------------------------------------|---------------|-----------------------|
| Constructed by the United States.....             | cubic yards.. | 565, 190              |
| Constructed by local authorities.....             | do.....       | <sup>1</sup> 355, 482 |
| Total constructed during the year.....            | do.....       | 920, 672              |
| Percentage of work done by the United States..... | per cent..    | 61.4                  |

The result has been to give added protection against floods. The completed levee line is 16.67 miles in length.

The work under construction and the progress thereon is shown in the following table and has resulted in increased protection against floods.

<sup>1</sup> Does not include 11,673 cubic yards placed on old levee at Clagett, not the controlling line.

*Lower Tensas levee district.*

| Name of levee.          | Kind of work.            | Miles below Cairo. | Length.      | Average height. | In contract         |
|-------------------------|--------------------------|--------------------|--------------|-----------------|---------------------|
|                         |                          |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Dunn.....               | New and enlargement..... | 611.5 R.           | 3,700        | 21.6            | 101,989.3           |
| Hodge.....              | Enlargement.....         | 613.5 R.           | 4,493        | 22.1            | 89,952.1            |
| Hunter.....             | do.....                  | 614 R.             | 3,600        | 24.6            | 87,702.6            |
| Diamond Island.....     | do.....                  | 611.5 R.           | 3,300        | 24.9            | 91,426.4            |
| Shelulah.....           | do.....                  | 615 R.             | 4,300        | 25.1            | 106,676.9           |
| Bayou Roundaway.....    | do.....                  | 616 R.             | 7,900        | 16.1            | 91,015.7            |
| Loyd.....               | do.....                  | 631 R.             | 12,010       | 19.3            | 205,653.2           |
| Elk Ridge, lot 1.....   | do.....                  | 631.5 R.           | 5,555        | 25.4            | 167,319.5           |
| Elk Ridge, lot 2.....   | do.....                  | 631.5 R.           | 5,717        | 26.9            | 173,407.8           |
| White Oak Lake.....     | do.....                  | 630-2 R.           | 17,186       | 21.0            | 51,235.5            |
| Hard Times.....         | do.....                  | 635-8 R.           | 11,223       | 22.5            | 274,684.4           |
| Winter quarters, 1..... | do.....                  | 638-9 R.           | 6,663        | 26.2            | 199,522.3           |
| Winter quarters, 2..... | do.....                  | 639-40 R.          | 7,267        | 23.6            | 211,061.2           |
| Botany Bay, lot 1.....  | do.....                  | 641 R.             | 7,150        | 22.6            | 193,671.7           |
| Botany Bay, lot 2.....  | do.....                  | 642 R.             | 7,900        | 22.3            | 200,305.3           |
| Botany Bay, lot 3.....  | do.....                  | 643 R.             | 8,460        | 21.0            | 198,696.2           |
| Kempe.....              | New and enlargement..... | 656 R.             | 4,328        | 23.0            | 173,953.0           |
|                         |                          |                    |              |                 | 2,618,303.8         |

| Name of levee.          | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.      | Required to complete. |
|-------------------------|---------------------|-----------------------|-----------------------|------------|-----------------------|
|                         | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |            | <i>Cubic yards.</i>   |
| Dunn.....               | 23,792.85           | 23,074.48             | 14.98                 | \$3,456.56 | 22,736.56             |
| Hodge.....              |                     |                       | 23.40                 |            | 86,374.58             |
| Hunter.....             | 71,189.50           | 79,732.99             | 20.90                 | 16,664.19  |                       |
| Diamond Island.....     |                     |                       | 24.70                 |            | 91,426.46             |
| Shelulah.....           | 20,963.59           | 16,222.98             | 25.70                 | 4,169.31   | 85,713.22             |
| Bayou Roundaway.....    | 27,771.90           | 41,432.01             | 16.40                 | 6,794.85   |                       |
| Loyd.....               | 90,505.61           | 62,895.10             | 29.00                 | 18,239.46  | 115,147.66            |
| Elk Ridge, lot 1.....   | 167,349.57          | 132,781.12            | 27½                   | 37,012.74  |                       |
| Elk Ridge, lot 2.....   | 56,298.00           | 10,171.81             | 27½                   | 2,835.39   | 117,109.83            |
| White Oak Lake.....     | 17,984.25           | 18,021.25             | 42.90                 | 7,731.12   |                       |
| Hard Times.....         |                     |                       | 27.96                 |            | 274,684.45            |
| Winter quarters, 1..... |                     |                       | 27.96                 |            | 199,522.34            |
| Winter quarters, 2..... |                     |                       | 27.96                 |            | 211,061.25            |
| Botany Bay, lot 1.....  |                     |                       | 27.96                 |            | 193,671.72            |
| Botany Bay, lot 2.....  |                     |                       | 27.96                 |            | 200,305.37            |
| Botany Bay, lot 3.....  |                     |                       | 27.96                 |            | 198,696.21            |
| Kempe.....              | 86,324.71           | 83,811.55             | 31.50                 | 26,400.63  | 87,618.37             |
|                         |                     |                       |                       |            |                       |
|                         |                     |                       | 565,189.98            | 468,143.29 | 123,304.25            |
|                         |                     |                       |                       |            | 1,884,367.96          |

Work on various levees was commenced and finished as follows:

| Name of levee.              | Miles below Cairo. | Work commenced. | Work finished. | Remarks.            |
|-----------------------------|--------------------|-----------------|----------------|---------------------|
| Dunn.....                   | 611.5 R.           | May 24, 1916    |                | Under construction. |
| Hodge.....                  | 613.5 R.           | June 10, 1916   |                | Work suspended.     |
| Hunter.....                 | 614 R.             | Aug. 14, 1915   | Nov. 21, 1917  |                     |
| Diamond Island.....         | 611.5 R.           |                 |                | Not begun.          |
| Shelulah.....               | 615 R.             | July 21, 1917   |                | Work suspended.     |
| Bayou Roundaway.....        | 616 R.             | Oct. 28, 1915   | Aug. 11, 1917  |                     |
| Loyd.....                   | 631 R.             | Jan. 1, 1918    |                | Under construction. |
| Elk Ridge, lot 1.....       | 631.5 R.           | Dec. 15, 1917   | June 25, 1918  |                     |
| Elk Ridge, lot 2.....       | 631.5 R.           | Jan. 1, 1918    |                | Do.                 |
| White Oak Lake.....         | 630-32 R.          | Nov. 15, 1916   | Oct. 5, 1917   |                     |
| Hard Times.....             | 635-38 R.          | May 25, 1918    |                | Preparatory work.   |
| Winter quarters, lot 1..... | 638-39 R.          | do              |                | Do.                 |
| Winter quarters, lot 2..... | 639-40 R.          | do              |                | Do.                 |
| Botany Bay, lot 1.....      | 641 R.             | do              |                | Do.                 |
| Botany Bay, lot 2.....      | 642 R.             | do              |                | Do.                 |
| Botany Bay, lot 3.....      | 643 R.             | do              |                | Do.                 |
| Kempe.....                  | 656 R.             | Oct. 21, 1917   |                | Work suspended.     |

*Contracts in force.*

| Name of contractor.           | Amount of work.     | Character of work.       | Unit price.      | Date of approval. |
|-------------------------------|---------------------|--------------------------|------------------|-------------------|
|                               | <i>Cubic yards.</i> |                          | <i>Cents.</i>    | 1915.             |
| E. H. Jackson.....            | 101,989.56          | New and enlargement..... | 14.98            | Nov. 13           |
| V. C. Mullen.....             | 89,952.14           | Enlargement.....         | 23.40            | do....            |
| Do.....                       | 91,426.46           | do.....                  | 24.70            | do....            |
| Do.....                       | 106,676.81          | do.....                  | 25.70            | do....            |
| Forest Construction Co.....   | 205,653.21          | do.....                  | 29.00            | 1918.<br>Jan. 12  |
| Helgason, Bros.....           | 167,349.57          | do.....                  | 27 $\frac{7}{8}$ | 1917.<br>Dec. 1   |
| Do.....                       | 173,407.83          | do.....                  | 27 $\frac{7}{8}$ | do....            |
| Dameron-White Co. (Ltd.)..... | 274,684.45          | do.....                  | 27.96            | 1918.<br>Jan. 16  |
| Do.....                       | 199,522.34          | do.....                  | 27.96            | do....            |
| Do.....                       | 211,061.25          | do.....                  | 27.96            | Do.....           |
| Do.....                       | 193,671.72          | do.....                  | 27.96            | Do.....           |
| Do.....                       | 200,305.37          | do.....                  | 27.96            | Do.....           |
| Do.....                       | 198,696.21          | do.....                  | 27.96            | Do.....           |
| Francis T. Constant.....      | 173,953.08          | New and enlargement..... | 31.50            | 1916.<br>Nov. 20  |
|                               | 2,388,350.00        |                          |                  |                   |

| Name of contractor.           | Date of beginning. | Date of expiration. | Percentage complete. | Name of levee.              | Miles below Cairo. |
|-------------------------------|--------------------|---------------------|----------------------|-----------------------------|--------------------|
|                               | 1915.              | 1916.               |                      |                             |                    |
| E. H. Jackson.....            | Oct. 13            | Dec. 15             | 77.6                 | Dunn.....                   | 611.5 R.           |
| V. C. Mullen.....             | Oct. 12            | do.                 | 3.6                  | Hodge.....                  | 613.5 R.           |
| Do.....                       | do.                | do.                 |                      | Diamond Island              | 614.5 R.           |
| Do.....                       | do.                | do.                 | 19.6                 | Shelulah.....               | 615 R.             |
|                               | 1918.              | 1918.               |                      |                             |                    |
| Forest Construction Co.....   | Jan. 28            | Dec. 31             | 44.0                 | Loyd.....                   | 631 R.             |
| Helgason Bros.....            | Jan. 23            | do.                 | 100.0                | Elk Ridge, lot 1.....       | 631.5 R.           |
| Do.....                       | do.                | do.                 | 32.4                 | Elk Ridge, lot 2.....       | 631.5 R.           |
| Dameron-White Co. (Ltd.)..... | Feb. 2             | do.                 |                      | Hard Times.....             | 635-8 R.           |
| Do.....                       | do.                | do.                 |                      | Winter quarters, lot 1..... | 638-9 R.           |
| Do.....                       | do.                | do.                 |                      | Winter quarters, lot 2..... | 639-40 R.          |
| Do.....                       | do.                | do.                 |                      | Botany Bay, lot 1.....      | 641 R.             |
| Do.....                       | do.                | do.                 |                      | Botany Bay, lot 2.....      | 642 R.             |
| Do.....                       | do.                | do.                 |                      | Botany Bay, lot 3.....      | 643 R.             |
| Francis T. Constant.....      | 1916.<br>Nov. 15   | Jan. 5              | 45.8                 | Kempe.....                  | 656 R.             |

*Condition at end of fiscal year.*—The following is the condition of the levee at the end of the fiscal year (June 30, 1918) :

|                                                                                                                                  |                         |            |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------|
| Project for earthwork.....                                                                                                       | per cent completed..... | 69.2       |
| Miles in system.....                                                                                                             |                         | 157.45     |
| Miles built.....                                                                                                                 |                         | 150.50     |
| Yardage lost during the year.....                                                                                                |                         | 273,863    |
| Contents of levee June 30, 1918.....                                                                                             | cubic yards.....        | 31,598,752 |
| Required to bring levee to grade and section.....                                                                                | do.....                 | 12,141,824 |
| Required to bring levee to grade and section and to construct new levees which will be necessary within the next five years..... | cubic yards.....        | 15,273,324 |
| Miles of levee above highest water:                                                                                              |                         |            |
| Less than 1 foot.....                                                                                                            |                         | 6.82       |
| From 1 to 2 feet.....                                                                                                            |                         | 19.93      |
| From 2 to 3 feet.....                                                                                                            |                         | 55.29      |
| From 3 to 4 feet.....                                                                                                            |                         | 26.36      |
| From 4 to 5 feet.....                                                                                                            |                         | 16.32      |
| Miles of levee up to grade but deficient in section.....                                                                         |                         | 9.11       |
| Miles of levee up to full grade and section.....                                                                                 |                         | 16.67      |

<sup>1</sup> Does not include 1,884,368 cubic yards under contract.

*Local cooperation.*—Local authorities have expended, in part, and between 1882 and January 1, 1918, \$3,678,172.10 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered. Under conditions of the flood-control bill (H. R. 14777, 64th Cong.), requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission," the fifth Louisiana levee district has contributed, for work under existing project, \$157,500.

*Terminal facilities.*—There are regular landing places at St. Joseph, La. (648.3 R.), and at Fort Adams, Miss. (755 L.), for steamboats plying on the Mississippi River discharging and receiving freight. The physical connection is by teams hauling over the graded banks and approaches over the levees to the water's edge. There are covered warehouses of an elementary type at each of the places to shelter freight, principally cotton and cotton seed, to be shipped and merchandise received for local consumption. The landing places are several miles distant from the settlements which they serve.

*Effect of improvement.*—The effect of the improvement is to give an increasingly reliable protection against floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded and any delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*Reference to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$5,375,441:

|                                       |                |
|---------------------------------------|----------------|
| New work                              | \$4,962,717.50 |
| Maintenance                           | 412,723.50     |
| Net total expended                    | 5,375,441.00   |
| Total appropriations to June 30, 1918 | 5,899,563.38   |

| Fiscal year ending June 30.        | 1914         | 1915         | 1916         | 1917         | 1918         |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|
| Expended for new work <sup>1</sup> | \$579,918.88 | \$162,846.41 | \$150,505.89 | \$134,487.52 | \$205,917.80 |
| Expended for maintenance           | 58,823.97    |              | 30,316.34    | 2,343.63     | 4,087.90     |
| Total expended <sup>1</sup>        | 638,742.85   | 162,846.41   | 180,822.23   | 136,831.15   | 210,005.70   |
| Appropriated or allotted           | 275,000.00   | 248,000.00   | 324,000.00   | 315,612.88   |              |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                |              |
|----------------------------------------------------------------|--------------|
| July 1, 1917, balance unexpended                               | \$418,813.20 |
| Amount appropriated by sundry civil act approved June 12, 1917 | 315,612.88   |
| Receipts from sales, etc., during fiscal year 1918             | 2.00         |

734,428.08

|                                                                 |              |
|-----------------------------------------------------------------|--------------|
| June 30, 1918, amount expended during fiscal year: <sup>1</sup> |              |
| For new work                                                    | \$205,917.80 |
| For maintenance                                                 | 4,087.90     |
|                                                                 | 210,005.70   |
| July 1, 1918, balance unexpended                                | 524,422.38   |

|                                                       |            |
|-------------------------------------------------------|------------|
| July 1, 1918, amount covered by uncompleted contracts | 524,422.38 |
|-------------------------------------------------------|------------|

|                                                                                   |                             |
|-----------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920        | <sup>2</sup> Indeterminate. |

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

mount contributed for improvement of Mississippi River in lower Tensas levee district.

## SPECIAL FUNDS.

mount contributed (for expenditure in the lower Tensas levee district, by the board of commissioners, fifth Louisiana levee district) \$157,500  
 amount covered by uncompleted contracts 157,500

## (b) Atchafalaya levee district.

*Location and description.*—The Atchafalaya levee district extends on the right bank of the Mississippi River from Red River, 764 miles below Cairo, to Bayou Lafourche, 886 miles below Cairo, with a river frontage of 122 miles and an area of 6,035 square miles. The levee line is continuous and is 127.35 miles in length, all of which has been built.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many levees and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, and slope one on three to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract and by hired labor, 1,242,150.21 cubic yards at a total cost of \$151,486.18.

The total work done by the United States and local authorities is as follows:

|                                  |             |              |
|----------------------------------|-------------|--------------|
| Constructed by the United States | cubic yards | 1,242,150.81 |
| Constructed by local authorities | do          | 896,723.00   |

|                                              |          |              |
|----------------------------------------------|----------|--------------|
| Total constructed during the year            | do       | 2,138,873.81 |
| Percentage of work done by the United States | per cent | 58.1         |

The result has been to give added protection against floods. Eighteen miles of levee have been completed to grade and section.

The work under construction and the progress thereon is shown in the following tables, and has resulted in increased protection against floods:

| Name of levee.                  | Kind of work.            | Miles below Cairo. | Length.      | Average height. | In contract.        |
|---------------------------------|--------------------------|--------------------|--------------|-----------------|---------------------|
|                                 |                          |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Old River.....                  | New and enlargement..... | 765 R.             | 38,575       | 13.5            | 527,376.5           |
| Red River Landing.....          | Enlargement.....         | 765 R.             | 7,004        | 20.9            | 197,871.9           |
| Smithland.....                  | New.....                 | 766.5 R.           | 5,095        | 16.5            | 244,415.7           |
| Henrietta.....                  | do.....                  | 767.8 R.           | 9,829        | 13.9            | 255,838.4           |
| Batchelor.....                  | New and enlargement..... | 772 R.             | 5,800        | 19.0            | 106,623.5           |
| Normandy.....                   | Enlargement.....         | 773.5 R.           | 5,700        | 19.9            | 104,653.7           |
| Unique.....                     | do.....                  | 775 R.             | 5,550        | 18.0            | 101,616.0           |
| Lacour, lot 2.....              | do.....                  | 780 R.             | 2,400        | 24.5            | 104,841.7           |
| Foster-Fleta <sup>1</sup> ..... | do.....                  | 783 R.             | 12,246       | .....           | 410,189.20          |
| T total.....                    |                          |                    |              |                 | 2,053,426.68        |

| Name of levee.                  | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.       | Required to complete. |
|---------------------------------|---------------------|-----------------------|-----------------------|-------------|-----------------------|
|                                 | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |             | <i>Cubic yards.</i>   |
| Old River.....                  | 237,765.13          | 208,330.22            | 11.25                 | \$23,941.67 | 289,611.43            |
| Red River Landing.....          | 98,565.34           | 73,506.76             | 13.47                 | 9,901.35    | 99,306.56             |
| Smithland.....                  | 244,715.75          | 244,715.45            | 13.47                 | 32,922.80   | .....                 |
| Henrietta.....                  | 255,862.12          | 255,838.44            | 13.47                 | 34,461.44   | .....                 |
| Batchelor.....                  | 59,676.89           | 63,321.23             | 9.23                  | 5,844.55    | .....                 |
| Normandy.....                   | 94,956.91           | 98,002.18             | 9.23                  | 9,045.60    | .....                 |
| Unique.....                     | 92,263.94           | 87,819.07             | 9.23                  | 8,105.70    | 9,352.08              |
| Lacour, lot 2.....              | 11,444.73           | 13,696.73             | 11.89                 | 1,628.54    | .....                 |
| Foster-Fleta <sup>1</sup> ..... | 176,900.00          | 176,900.00            | 11.02                 | 19,494.64   | 233,289.20            |
| Total.....                      | 242,150.21          | 1,222,130.08          | .....                 | 145,346.29  | 631,559.27            |

<sup>1</sup> Work being done by hired labor and United States plant.

Work was done by hired labor and with Government plant as follows:  
Machine (B-3)—Foster-Fleta:

|                    |            |
|--------------------|------------|
| Mobilization.....  | \$2,353.64 |
| Drainage.....      | 112.60     |
| Plowing.....       | 184.00     |
| Operation.....     | 13,145.33  |
| Repairs.....       | 3,597.32   |
| Surveys.....       | 101.75     |
| Depreciation.....  | 5,833.33   |
| Overhead.....      | 306.56     |
| Total cost.....    | 25,634.53  |
| Yards handled..... | 176,900    |
| Cost per yard..... | \$0.1449   |

Work on various levees was commenced and finished as follows:

| Name of levee.         | Miles below Cairo. | Work commenced. | Work finished. | Remarks.            |
|------------------------|--------------------|-----------------|----------------|---------------------|
| Old River.....         | 765 R.             | Nov. 5, 1917    | .....          | Under construction. |
| Red River Landing..... | 765 R.             | Mar. 11, 1918   | .....          | Do.                 |
| Smithland.....         | 765.5 R.           | Sept. 4, 1917   | Mar. 10, 1918  | .....               |
| Henrietta.....         | 765.8 R.           | May 14, 1917    | Sept. 6, 1917  | .....               |
| Batchelor.....         | 772 R.             | Dec. 20, 1916   | Oct. 16, 1917  | .....               |
| Normandy.....          | 773.5 R.           | Mar. 5, 1917    | Jan. 10, 1918  | .....               |
| Unique.....            | 775 R.             | Jan. 11, 1918   | .....          | Do.                 |
| Lacour, lot 2.....     | 780 R.             | May 18, 1915    | Oct. 17, 1917  | .....               |
| Foster Fleta.....      | 783 R.             | Feb. 20, 1918   | .....          | Do.                 |

*Contracts in force.*

| Name of contractor.       | Amount of work.                   | Character of work.   | Unit price.            | Date of approval. |
|---------------------------|-----------------------------------|----------------------|------------------------|-------------------|
| Asser Contracting Co..... | <i>Cubic yards.</i><br>527,376.56 | New and enlargement. | <i>Cents.</i><br>11.25 | Dec. 1, 1917      |
| Do.....                   | 197,871.90                        | Enlargement.....     | 13.47                  | Nov. 20, 1916     |
| Benson-Hamilton Co.....   | 101,616.02                        | .....do.....         | 9.23                   | Nov. 13, 1915     |

| Name of contractor.      | Date of beginning. | Date of expiration. | Complete.            | Name of levee.         | Miles below Cairo. |
|--------------------------|--------------------|---------------------|----------------------|------------------------|--------------------|
| Asser Contracting Co.... | Dec. 21, 1917      | Dec. 31, 1918       | <i>P'ct.</i><br>45.1 | Old River.....         | 765 R.             |
| Do.....                  | Apr. 1, 1917       | Jan. 31, 1918       | 49.8                 | Red River Landing..... | 765 R.             |
| Benson-Hamilton Co.....  | Nov. 30, 1915      | Dec. 15, 1916       | 90.8                 | Unique.....            | 775 R.             |

*Condition at end of fiscal year.*—The following is the condition of the levees at the end of the fiscal year (June 30, 1918) :

|                                                                                                                                             |                        |                         |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| Project for earthwork.....                                                                                                                  | per cent complete..... | 68.5                    |
| Files in system.....                                                                                                                        |                        | 127.40                  |
| Files built.....                                                                                                                            |                        | 127.40                  |
| Damage lost during the year.....                                                                                                            | cubic yards.....       | 761,214                 |
| Contents of levees (June 30, 1918).....                                                                                                     | do.....                | 27,124,343              |
| Required to bring levees to grade and section.....                                                                                          | do.....                | <sup>1</sup> 12,500,000 |
| Required to bring levees to grade and section and to construct new levees which will become necessary in the next 5 years, cubic yards..... |                        | 13,650,000              |
| Files of levee above highest water :                                                                                                        |                        |                         |
| Less than 1 foot.....                                                                                                                       |                        | 10.75                   |
| From 1 to 2 feet.....                                                                                                                       |                        | 38.17                   |
| From 2 to 3 feet.....                                                                                                                       |                        | 21.03                   |
| From 3 to 4 feet.....                                                                                                                       |                        | 19.01                   |
| From 4 to 5 feet.....                                                                                                                       |                        | None.                   |
| Files of levee up to grade but deficient in section.....                                                                                    |                        | 20.44                   |
| Files of levee up to full grade and section.....                                                                                            |                        | 18.00                   |

*Local cooperation.*—Local authorities have expended, in part, and between 1882 and January 1, 1918, \$10,672,949.39 in building, improving, and maintaining levee lines. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no account of them has been discovered. Under conditions of the flood-control bill (H. R. 14777, 64th Cong.), requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission," the Atchafalaya Basin Levee Board has contributed for work under existing project \$65,000.

*Terminal facilities.*—There are landing places at almost every plantation in this district to receive and discharge freight for local consumption. The physical connection with these landing places is by means of teams over earth roads and ramps over the levees and graded approaches to the landing places to the water's edge. At all these landings are covered warehouses of an elementary type to shelter freight received and shipped. All these places are also served by the Texas & Pacific Railroad passing in the rear of from 1 to 6 miles distant. The parishes in this district are now engaged in building good roads which will effectively serve water terminals throughout the district. The principal water terminals in the district having storage facilities for receiving and shipping freight are the following, named in order going downstream :

Torras, La. (765 R.).  
 Red River Landing, La. (766 R.).  
 Raccourci, La. (785 R.).  
 Morganza, La. (788.5 R.).  
 Point Coupee, La. (796 R.).  
 Cooks, La. (806 R.).

<sup>1</sup> Does not include 427,704.98 cubic yards under contract.

Hermitage, La. (808 R.).  
 Devalls, La. (823 R.).  
 Port Allen, La. (833 R.).  
 Plaquemine, La. (852.5 R.).  
 Bayou Goula, La. (867 R.).  
 White Castle, La. (868 R.).

*Effect of improvement.*—The effect of the improvement is to give increasingly reliable protection against floods. The work can not be allowed to remain without further operations. Complete protection is not yet afforded, and any delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section, adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$2,363,321.69:

|             |                   |
|-------------|-------------------|
| New work    | \$2, 207, 633. 64 |
| Maintenance | 155, 688. 05      |

|                    |                 |
|--------------------|-----------------|
| Net total expended | 2, 363, 321. 69 |
|--------------------|-----------------|

|                                       |                   |
|---------------------------------------|-------------------|
| Total appropriations to June 30, 1918 | 1 2, 532, 186. 99 |
|---------------------------------------|-------------------|

| Fiscal year ending June 30.                 | 1914          | 1915          | 1916          | 1917          | 1918          |
|---------------------------------------------|---------------|---------------|---------------|---------------|---------------|
| Expended for new work <sup>2</sup> .....    | \$137, 557 26 | \$66, 418. 47 | \$54, 058. 58 | \$112, 137 69 | \$33, 634. 35 |
| Expended for maintenance <sup>2</sup> ..... | 1, 825. 37    | .....         | 20, 338 66    | .....         | 5, 620. 93    |
| Total expended <sup>2</sup> .....           | 139, 392 63   | 66, 418. 47   | 74, 397. 24   | 112, 137 69   | 139, 255. 28  |
| Appropriated or allotted.....               | 125, 000. 00  | 85, 000. 00   | 171, 075. 90  | 131, 373. 51  | .....         |

|                                  |                |
|----------------------------------|----------------|
| July 1, 1917, balance unexpended | \$179, 119. 15 |
|----------------------------------|----------------|

|                                                                |              |
|----------------------------------------------------------------|--------------|
| Amount appropriated by sundry civil act approved June 12, 1917 | 131, 373. 51 |
|----------------------------------------------------------------|--------------|

310, 492. 66

|                                                                                  |            |
|----------------------------------------------------------------------------------|------------|
| Deduction on account of transfer to first and second Mississippi River districts | 2, 372. 08 |
|----------------------------------------------------------------------------------|------------|

308, 120. 58

June 30, 1918, amount expended during fiscal year: <sup>2</sup>

|              |                |
|--------------|----------------|
| For new work | \$133, 634. 35 |
|--------------|----------------|

|                 |            |
|-----------------|------------|
| For maintenance | 5, 620. 93 |
|-----------------|------------|

139, 255. 28

|                                  |              |
|----------------------------------|--------------|
| July 1, 1918, balance unexpended | 168, 865. 30 |
|----------------------------------|--------------|

|                                       |                          |
|---------------------------------------|--------------------------|
| July 1, 1918, outstanding liabilities | <sup>3</sup> 47, 591. 79 |
|---------------------------------------|--------------------------|

|                                                       |              |
|-------------------------------------------------------|--------------|
| July 1, 1918, amount covered by uncompleted contracts | 121, 273. 51 |
|-------------------------------------------------------|--------------|

168, 865. 30

|                                                                                   |                             |
|-----------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project | <sup>4</sup> Indeterminate. |
|-----------------------------------------------------------------------------------|-----------------------------|

|                                                                            |                             |
|----------------------------------------------------------------------------|-----------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920 | <sup>4</sup> Indeterminate. |
|----------------------------------------------------------------------------|-----------------------------|

<sup>1</sup> Total amount \$2,534,559.07; \$2,372.08 transferred to first and second Mississippi River district.

<sup>2</sup> Not deducting receipts from sales, etc.

<sup>3</sup> Part of cost of levee building machine, etc., included.

<sup>4</sup> Exclusive of available funds.

*Amount contributed for improvement of Mississippi River in Atchafalaya levee district.*

## SPECIAL FUNDS.

|                                                                                                                                               |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Amount contributed (for expenditure in the lower Tensas levee district, by the board of commissioners, Atchafalaya Basin levee district)----- | \$65,000 |
| Amount covered by uncompleted contracts-----                                                                                                  | 65,000   |

*(c) Lafourche levee district.*

*Location and description.*—The Lafourche levee district extends on the right bank from Bayou Lafourche, 886 miles below Cairo, to New Orleans, 964 miles below Cairo, with a river frontage of 78 miles. The Lafourche and Barataria levee districts comprise the same basin with a total area of 2,020 square miles. The levee line is continuous, 82.21 miles in length, all of which has been built.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many levees and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time, and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract and by hired labor, 1,151,532.40 cubic yards, at a total cost of \$141,593.15.

The total work done by the United States and local authorities is as follows:

|                                       |               |           |
|---------------------------------------|---------------|-----------|
| Constructed by the United States----- | cubic yards-- | 1,157,532 |
| Constructed by local authorities----- | do-----       | 982,981   |

|                                        |         |           |
|----------------------------------------|---------|-----------|
| Total constructed during the year----- | do----- | 2,140,513 |
|----------------------------------------|---------|-----------|

|                                     |            |    |
|-------------------------------------|------------|----|
| Work done by the United States----- | per cent-- | 54 |
|-------------------------------------|------------|----|

The effect has been to give increased security against floods. The completed levee line is 20.06 miles in length.

The work under construction and the progress thereon is shown in the following tables, and has resulted in increased protection against floods:

| Name of levee.       | Kind of work.          | Miles below Cairo. | Length.      | Average height. | In contract.        |
|----------------------|------------------------|--------------------|--------------|-----------------|---------------------|
|                      |                        |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Brilliant Point..... | New and enlarging..... | 900.5 R.           | 26,418       | 15.0            | 499,280.74          |
| Bon Secour.....      | Enlarging.....         | 907.9 R.           | 7,853        | 15.5            | 159,275.55          |
| Pikes Peak.....      | do.....                | 910 R.             | 3,583        | 17.0            | 85,248.13           |
| Delogney.....        | do.....                | 911.12 R.          | 11,005       | 17.1            | 238,925.56          |
| Wallswood.....       | New and enlarging..... | 952 R.             | 20,960       | 17.5            | 442,532.34          |
| Lower Avondale.....  | Enlarging.....         | 955 R.             | 651          | 18.5            | 10,255.32           |
| Fairfield.....       | New.....               | 955.5 R.           | 3,411        | 18.0            | 210,114.62          |
| Total.....           |                        |                    |              |                 | 1,457,535.26        |

| Name of levee.       | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.       | Required to complete. |
|----------------------|---------------------|-----------------------|-----------------------|-------------|-----------------------|
|                      | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |             | <i>Cubic yards.</i>   |
| Brilliant Point..... | 290,110.48          | 290,110.48            | 12 23                 | \$35,480.51 | 209,170.26            |
| Bon Secour.....      | 55,499.14           | 55,499.14             | 12 23                 | 6,787.55    | 103,676.41            |
| Pikes Peak.....      | 85,248.13           | 85,248.13             | 12 23                 | 10,425.84   | .....                 |
| Delogney.....        | 160,077.37          | 160,077.37            | 9.95                  | 15,927.81   | 79,848.19             |
| Wallswood.....       | 346,227.34          | 346,227.34            | 10 23                 | 35,419.06   | .....                 |
| Lower Avondale.....  | 10,255.32           | 10,255.32             | 18.00                 | 1,853.38    | .....                 |
| Fairfield.....       | 210,114.62          | 210,114.62            | 11.42                 | 23,003.17   | .....                 |
| Total.....           | 1,157,532.40        | 1,157,532.40          |                       | 128,897.32  | .....                 |

<sup>1</sup> Constructed by hired labor.

Work was done by hired labor and with Government plant as follows:

| Machine and location.    | Mobilization. | Cleaning. | Plowing. | Operation.  | Repairs.   | Dressing.  |
|--------------------------|---------------|-----------|----------|-------------|------------|------------|
| B-1. Delogney.....       | \$726.69      | \$285.03  | \$108.60 | \$12,326.72 | \$1,131.16 | \$1,216.00 |
| B-2. Lower Avondale..... | .....         | 64.80     | 12.00    | 1,253.22    | 384.16     | 118.00     |
| B-2, B-6. Fairfield..... | 3,474.66      | 469.14    | 64.00    | 22,359.28   | 4,017.93   | 2,167.36   |

| Machine and location.    | Sodding. | Surveys. | Depreciation. | Overhead. | Total cost. | Handled.      | Cost per cubic yard. |
|--------------------------|----------|----------|---------------|-----------|-------------|---------------|----------------------|
|                          |          |          |               |           |             | <i>Yards.</i> |                      |
| B-1. Delogney.....       | \$108.00 | \$25.61  | \$1,956.00    | \$631.00  | \$18,514.81 | 160,077.37    | \$0.1157             |
| B-2. Lower Avondale..... | 14.00    | 7.20     | 329.00        | 81.83     | 2,264.21    | 10,255.32     | .2208                |
| B-2, B-6. Fairfield..... | 124.00   | 24.80    | 7,665.00      | 2,033.00  | 32,701.17   | 210,114.62    | .1556                |

Work on various levees was commenced and finished as follows:

| Name of levee.       | Miles below Cairo. | Work commenced. | Work completed. |
|----------------------|--------------------|-----------------|-----------------|
| Brilliant Point..... | 900-5 R.           | Oct. 17, 1917   | (1)             |
| Bon Secour.....      | 907-9 R.           | May 6, 1918     | (1)             |
| Pikes Peak.....      | 910 R.             | Jan. 23, 1918   | Apr. 20, 1918   |
| Delogney.....        | 911-12 R.          | Mar. 4, 1918    | (1)             |
| Wallswood.....       | 952 R.             | Dec. 21, 1916   | Jan. 5, 1918    |
| Avondale.....        | 955 R.             | Nov. 23, 1917   | Dec. 7, 1917    |
| Fairfield.....       | 955.5 R.           | June 1, 1917    | June 25, 1918   |

<sup>1</sup> Under construction.

*Contracts in force.*

| Name of contractor.                 | Amount of work. | Character of work.       | Unit prices.  | Date of approval. |
|-------------------------------------|-----------------|--------------------------|---------------|-------------------|
|                                     | <i>Yards.</i>   |                          | <i>Cents.</i> |                   |
| D. B. Hearin & Son and O. O. Ogden- | 85,248.13       | Enlargement.....         | 12.23         | Dec. 1, 1917      |
| Do.....                             | 497,336.90      | Enlargement and new..... | 12.23         | Do.               |
| Do.....                             | 164,223.51      | Enlargement.....         | 12.23         | Do.               |

| Name of contractor.                    | Date of beginning. | Date of expiration. | Com-<br>pleted. | Name of levee.       | Miles below<br>Cairo. |
|----------------------------------------|--------------------|---------------------|-----------------|----------------------|-----------------------|
|                                        |                    |                     | <i>Per ct.</i>  |                      |                       |
| D. B. Hearin & Son and<br>O. O. Ogden. | Dec. 23, 1917      | Dec. 31, 1918       | 100             | Pikes Peak.....      | 910 R.                |
| Do.....                                | do.....            | do.....             | 58              | Brilliant Point..... | 900-5 R.              |
| Do.....                                | do.....            | do.....             | 33              | Bon Secour.....      | 907-9 R.              |

*Conditions at end of fiscal year.*—The following is the condition of the levee at end of the fiscal year (June 30, 1918):

|                                                                                                                                  |                         |            |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------|
| Project for earthwork.....                                                                                                       | per cent completed..... | 83.3       |
| Miles in system.....                                                                                                             |                         | 82.30      |
| Miles built.....                                                                                                                 |                         | 82.30      |
| Yardage lost during the year.....                                                                                                | cubic yards.....        | 383,581    |
| Contents of levee (June 30, 1918).....                                                                                           | do.....                 | 14,391,771 |
| Required to bring levees to grade and section.....                                                                               | do.....                 | 2,871,285  |
| Required to bring levees to grade and section and to build new levees<br>which will become necessary in the next five years..... | cubic yards.....        | 4,321,285  |
| Miles of levee above highest water:                                                                                              |                         |            |
| Less than 1 foot.....                                                                                                            |                         | 0.28       |
| From 1 to 2 feet.....                                                                                                            |                         | 8.71       |
| From 2 to 3 feet.....                                                                                                            |                         | 13.43      |
| From 3 to 4 feet.....                                                                                                            |                         | 17.51      |
| From 4 to 5 feet.....                                                                                                            |                         | None.      |
| Miles of levee up to grade but deficient in section.....                                                                         |                         | 22.31      |
| Miles of levee up to full grade and section.....                                                                                 |                         | 20.06      |

*Local cooperation.*—Local authorities have expended in part, and between 1882 and January 1, 1918, \$6,075,018.30 in building, improving, and maintaining levee lines. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered. Under conditions of the act of Congress (H. R. 14777, 64th Cong.) requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission," the Lafourche levee district has contributed for work under the existing project \$42,500.

*Terminal facilities.*—There are the usual landings for steamboats plying on the Mississippi River in this district for receiving and discharging freight in front of all plantations. As this district is thickly settled, due to its being a sugar-cane growing district, the roads serving the landings are, as a rule, kept in fair condition all the year around. The physical connection between these roads and the landings is by means of teams hauling over earth roads and ramps over the levees and graded approaches to the landing places at the water's edge. The warehouses to shelter freight received and shipped are of an elementary type, but serve well the character of the merchandise handled. This district is also served immediately in the rear by the Texas & Pacific Railroad. The principal water terminals in this district having facilities for receiving and shipping freight are the following named, in order, downstream:

Donaldsonville, La. (885.4 R.).

Lauderdale, La. (898.2 R.).

St. James, La. (905.5 R.).

Hahnville, La. (939.4 R.).

Luling, La. (942.7 R.).

Waggaman, La. (955 R.).

At Avondale, La. (955.8 R.), the Southern Pacific Railroad Co. operates a transfer boat for passengers and freight trains, with the usual terminal facilities.

ties of substantial approaches, but no shelter of any kind. This terminal is within the port of New Orleans. Westwego, La. (961.8 R.), is the terminal of the Texas & Pacific Railroad. It has substantially constructed covered warehouses and grain elevators and wharves of creosoted timber, with railroad tracks on the wharves near the water's edge convenient for loading from railroad cars freight direct to outbound seagoing ships.

*Effect of improvement.*—The effect of the improvement has been to give increasingly reliable protection against floods. Complete protection is not yet afforded and any delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$1,166,990.91:

|                  |                   |
|------------------|-------------------|
| New work.....    | \$1, 057, 734. 84 |
| Maintenance..... | 109, 256. 07      |

|                         |                 |
|-------------------------|-----------------|
| Net total expended..... | 1, 166, 990. 91 |
|-------------------------|-----------------|

|                                            |                 |
|--------------------------------------------|-----------------|
| Total appropriations to June 30, 1918..... | 1, 191, 843. 16 |
|--------------------------------------------|-----------------|

| Fiscal year ending June 30.                 | 1914           | 1915          | 1916          | 1917          | 1918           |
|---------------------------------------------|----------------|---------------|---------------|---------------|----------------|
| Expended for new work <sup>1</sup> .....    | \$119, 931. 38 | \$77, 715. 78 | \$22, 507. 55 | \$35, 673. 99 | \$133, 842. 47 |
| Expended for maintenance <sup>1</sup> ..... | 1, 009. 07     | .....         | 13, 565. 69   | .....         | 7, 452. 85     |
| Total expended <sup>1</sup> .....           | 120, 940. 45   | 77, 715. 78   | 36, 073. 24   | 35, 673. 99   | 141, 295. 32   |
| Appropriated or allotted.....               | 100, 000. 00   | 25, 000. 00   | 100, 000. 00  | 86, 292. 10   | .....          |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                     |               |
|---------------------------------------------------------------------|---------------|
| July 1, 1917, balance unexpended.....                               | \$79, 855. 47 |
| Amount appropriated by sundry civil act approved June 12, 1917..... | 86, 292. 10   |

\$166, 147. 57

June 30, 1918, amount expended during fiscal year:<sup>1</sup>

|                      |                |
|----------------------|----------------|
| For new work.....    | \$133, 842. 47 |
| For maintenance..... | 7, 452. 85     |

141, 295. 32

|                                       |             |
|---------------------------------------|-------------|
| July 1, 1918, balance unexpended..... | 24, 852. 25 |
|---------------------------------------|-------------|

|                                            |            |
|--------------------------------------------|------------|
| July 1, 1918, outstanding liabilities..... | 6, 077. 39 |
|--------------------------------------------|------------|

|                                                            |             |
|------------------------------------------------------------|-------------|
| July 1, 1918, amount covered by uncompleted contracts..... | 18, 774. 86 |
|------------------------------------------------------------|-------------|

24, 852. 25

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
|----------------------------------------------------------------------------------------|-----------------------------|

|                                                                                 |                             |
|---------------------------------------------------------------------------------|-----------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920..... | <sup>2</sup> Indeterminate. |
|---------------------------------------------------------------------------------|-----------------------------|

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

*Funds contributed for improvement of Mississippi River in Lafourche levee district.*

## SPECIAL FUNDS.

Amount contributed (for expenditure in the Lafourche levee district, by the board of commissioners, Lafourche Basin levee district)----- \$42, 500  
 Amount covered by uncompleted contracts----- 42, 500

*(d) Barataria levee district.*

*Location and description.*—The Barataria levee district extends on the right bank from the lower limits of New Orleans, 981.5 miles below Cairo, to the Head of the Passes, 1,064 miles below Cairo, with a river frontage of 82.5 miles. The levee line is continuous to the Jump, 71.12 miles. The total area protected in this and the Lafourche district is 2,020 square miles.

*Original condition.*—Originally, there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope 1 on 3, land slope 1 on 3 to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, and by hired labor, 154,833.68 cubic yards at a total cost of \$26,753.32.

The total work done by the United States and local authorities is as follows:

Constructed by the United States-----cubic yards-- 154, 833  
 Constructed by local authorities-----do----- 108, 511

Total constructed during the year-----do----- 263, 344  
 Work done by the United States-----per cent-- 58. 79

The work under construction and the progress thereon is shown in the following tables and has resulted in increased protection against floods:

| Name of levee.         | Kind of work.            | Miles below Cairo. | Length.      | Average height. | In contract.        |
|------------------------|--------------------------|--------------------|--------------|-----------------|---------------------|
|                        |                          |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Belle Chasse.....      | New.....                 | 988 R.             | 1, 587       | 13. 0           | 40, 425             |
| Live Oak.....          | Enlarging.....           | 994 R.             | 12, 100      | 12. 0           | 55, 529             |
| Happy Point.....       | New and enlargement..... | 997 R.             | 4, 206       | 12. 0           | 44, 604             |
| Deer Range.....        | do.....                  | 1, 008 R.          | 11, 158      | 12. 0           | 75, 093             |
| Lagnolia.....          | do.....                  | 1, 015 R.          | 14, 040      | 10. 5           | 67, 387             |
| Lower Riceland.....    | do.....                  | 1, 019 R.          | 3, 490       | 12. 2           | 44, 349             |
| Shoddy to Reddick..... | do.....                  | 1, 038-41 R.       | 19, 916      | 8. 0            | 95, 285             |
| Total.....             |                          |                    |              |                 | 422, 402            |

| Name of levee.         | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.                     | Required to complete. |
|------------------------|---------------------|-----------------------|-----------------------|---------------------------|-----------------------|
|                        | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |                           | <i>Cubic yards.</i>   |
| Belle Chasse.....      | 40, 425. 00         | 40, 425. 00           | 12. 84                | <sup>1</sup> \$5, 190. 31 |                       |
| Live Oak.....          | 55, 259. 00         | 55, 259. 00           | 15. 57                | <sup>2</sup> 8, 601. 60   |                       |
| Happy Point.....       |                     |                       | 15. 40                |                           | 44, 604               |
| Deer Range.....        | 47, 643. 78         | 47, 643. 78           | 15. 94                | 7, 594. 42                | 27, 450               |
| Lagnolia.....          |                     |                       | 19. 54                |                           | 67, 387               |
| Lower Riceland.....    | 2, 000. 00          | 2, 000. 00            | 39. 89                | <sup>3</sup> 797. 87      | ( <sup>4</sup> )      |
| Shoddy to Reddick..... | 9, 505. 90          | 9, 505. 90            | 19. 00                | 1, 806. 12                | ( <sup>4</sup> )      |
| Total.....             | 154, 833. 68        | 154, 833. 68          |                       | 23, 990. 32               |                       |

<sup>1</sup> Cost by hired labor.

<sup>2</sup> Grading and dressing completed by wheelbarrows.

<sup>3</sup> Average cost for completed work, \$17.08.

<sup>4</sup> Completed by contract.

*Cost of construction of wooden revetment.*

|                                                           | Linear feet. | Cost.      |
|-----------------------------------------------------------|--------------|------------|
| Belle Chasse wooden revetment (988 R.) <sup>1</sup> ..... | 1,587        | \$4,036.61 |
| Live Oak wooden revetment (994 R.).....                   | 9,389        | 12,389.48  |
| Deer Range wooden revetment (1,008 R.).....               |              | 1,971.20   |
| Rhodey to Reddick wooden revetment.....                   | 7,527        | 8,774.00   |

<sup>1</sup> This revetment was built with a creosoted footing.

Work was done by hired labor and with Government plant as follows:

| Machine and location.  | Mobilization. | Clearing. | Draining. | Plowing. | Operations. | Repairs. | Dressing. |
|------------------------|---------------|-----------|-----------|----------|-------------|----------|-----------|
| B-1, Belle Chasse..... | \$561.30      | \$90.82   | .....     | \$54.00  | \$3,373.79  | \$524.24 | \$545.36  |
| B-1, Live Oak.....     | 493.69        | 971.36    | \$24.80   | 165.00   | 4,946.73    | 1,011.09 | 840.00    |

| Machine and location.  | Sodding. | Surveys. | Depreciation. | Overhead. | Total cost. | Handled.                | Cost per yard. |
|------------------------|----------|----------|---------------|-----------|-------------|-------------------------|----------------|
| B-1, Belle Chasse..... | \$28.80  | \$12.00  | \$690.00      | \$323.00  | \$6,203.31  | <i>Yards.</i><br>40,425 | \$0.1534       |
| B-1, Live Oak.....     | 104.00   | 44.93    | 1,150.00      | 600.00    | 10,351.60   | 55,259                  | .1873          |

Work on various levees was commenced and finished as follows:

| Name of levee.                         | Miles below Cairo. | Work commenced. | Work finished. | Remarks.            |
|----------------------------------------|--------------------|-----------------|----------------|---------------------|
| Belle Chasse.....                      | 988 R.             | Nov. 12, 1917   | Dec. 17, 1917  |                     |
| Belle Chasse, wood revetment.....      | 988 R.             | Feb. 18, 1918   | Mar. 30, 1918  |                     |
| Live Oak.....                          | 994 R.             | Dec. 18, 1917   | Feb. 13, 1918  |                     |
| Live Oak, wood revetment.....          | 994 R.             | Feb. 25, 1918   | June 10, 1918  |                     |
| Happy Point.....                       | 997 R.             | .....           | .....          | Work not begun.     |
| Deer Range.....                        | 1,008 R.           | Feb. 26, 1918   | .....          | Under construction. |
| Deer Range, wood revetment.....        | 1,008 R.           | June 17, 1918   | .....          | Do.                 |
| Magnolia.....                          | 1,015 R.           | .....           | .....          | Work not begun.     |
| Lower Riceland.....                    | 1,019 R.           | Dec. 12, 1916   | July 31, 1917  |                     |
| Rhodey to Reddick.....                 | 1,038-41 R.        | Jan. 19, 1917   | Nov. 30, 1917  |                     |
| Rhodey to Reddick, wood revetment..... | 1,038-41 R.        | Jan. 30, 1918   | Apr. 8, 1918   |                     |

*Contracts in force.*

| Name of contractor.      | Amount of work. | Character of work.       | Unit price.   | Date of approval. |
|--------------------------|-----------------|--------------------------|---------------|-------------------|
|                          | <i>Yards.</i>   |                          | <i>Cents.</i> |                   |
| Lester F. Alexander..... | 44,604          | Enlargement.....         | 15.4          | Dec. 1, 1917      |
| Do.....                  | 73,113          | Enlargement and new..... | 15.94         | Do.               |
| Do.....                  | 67,337          | Enlargement.....         | 19.54         | Do.               |

| Name of contractor.      | Date of beginning. | Date of expiration. | Completed.     | Name of levee.   | Miles below Cairo. |
|--------------------------|--------------------|---------------------|----------------|------------------|--------------------|
|                          |                    |                     | <i>Per ct.</i> |                  |                    |
| Lester F. Alexander..... | Jan. 15, 1918      | Dec. 31, 1918       | 100            | Happy Point..... | 997 R.             |
| Do.....                  | do.                | do.                 | 62.2           | Deer Range.....  | 1,008 R.           |
| Do.....                  | do.                | do.                 | 100            | Magnolia.....    | 1,015 R.           |

*Condition at end of fiscal year.*—The following is the condition of the levees at the end of the fiscal year (June 30, 1918):

|                                                                                                                                                     |                         |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Project for earthwork.....                                                                                                                          | per cent completed..... | 85.4      |
| Miles in system.....                                                                                                                                |                         | 71.15     |
| Miles built.....                                                                                                                                    |                         | 71.15     |
| Yardage lost by abandoning old levees.....                                                                                                          | cu. yds.....            | 125,067   |
| Contents of levees (June 30, 1918).....                                                                                                             | do.....                 | 4,930,709 |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years, cubic yards..... |                         | 1,137,623 |
| Required to bring levees to grade and section.....                                                                                                  | cu. yds.....            | 843,201   |
| Miles of levees above highest water:                                                                                                                |                         |           |
| Less than 1 foot.....                                                                                                                               |                         | .18       |
| From 1 to 2 feet.....                                                                                                                               |                         | 8.06      |
| From 2 to 3 feet.....                                                                                                                               |                         | 14.71     |
| From 3 to 4 feet.....                                                                                                                               |                         | 7.49      |
| Miles of levees up to full grade but deficient in section.....                                                                                      |                         | 2.28      |
| Miles of levees up to full grade and section.....                                                                                                   |                         | 38.43     |

*Local cooperation.*—Local authorities have expended between 1882 and January 1, 1918, \$732,733.51 in building, improving, and maintaining the levee line. Other expenditures since 1882 and heavy ones previous thereto are known to have been made, but no accurate record of them has been discovered. Under conditions of the flood-control bill (H. R. 14777, 64th Cong.), requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission," the following contributions for work under the existing project have been made:

|                               |          |
|-------------------------------|----------|
| Lafourche levee district..... | \$32,000 |
| Buras levee district.....     | 8,000    |

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. Complete protection is not yet afforded; any delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30 1918, after deducting receipts from sales, etc., amounting to \$894,122.42:

|                                            |              |
|--------------------------------------------|--------------|
| New work.....                              | \$756,653.85 |
| Maintenance.....                           | 137,468.57   |
| Net total expended.....                    | 894,122.42   |
| Total appropriations to June 30, 1918..... | 985,219.38   |

| Fiscal year ending June 30.                 | 1914        | 1915        | 1916        | 1917        | 1918        |
|---------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work <sup>1</sup> .....    | \$80,832.42 | \$63,210.15 | \$62,626.41 | \$42,458.58 | \$31,405.80 |
| Expended for maintenance <sup>1</sup> ..... | 6,580.25    | 1,572.49    | 10,536.69   | .....       | 26,137.30   |
| Total expended <sup>1</sup> .....           | 87,412.67   | 64,782.64   | 73,163.10   | 42,458.58   | 57,543.10   |
| Appropriated or allotted.....               | 75,000.00   | 60,000.00   | 95,000.00   | 80,496.51   | .....       |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                     |                    |
|---------------------------------------------------------------------|--------------------|
| July 1, 1917, balance unexpended.....                               | \$68, 143. 55      |
| Amount appropriated by sundry civil act approved June 12, 1917..... | 80, 496. 51        |
| Receipts from sales, etc., during fiscal year 1918.....             | 1. 25              |
|                                                                     | <hr/> 148, 641. 31 |

|                                                                  |                   |
|------------------------------------------------------------------|-------------------|
| June 30, 1918, amount expended during fiscal year : <sup>1</sup> |                   |
| For new work.....                                                | \$31, 405. 80     |
| For maintenance.....                                             | 26, 137. 30       |
|                                                                  | <hr/> 57, 543. 10 |

|                                                            |                   |
|------------------------------------------------------------|-------------------|
| July 1, 1918, balance unexpended.....                      | 91, 098. 21       |
| July 1, 1918, outstanding liabilities..... <sup>2</sup>    | \$59, 355. 98     |
| July 1, 1918, amount covered by uncompleted contracts..... | 31, 742. 23       |
|                                                            | <hr/> 91, 098. 21 |

|                                                                                                      |                |
|------------------------------------------------------------------------------------------------------|----------------|
| Amount (estimated) required to be appropriated for completion of existing project <sup>3</sup> ..... | Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920 <sup>3</sup> .....        | Indeterminate. |

*Funds contributed for improvement of Mississippi River in Barataria levee district.*

#### SPECIAL FUNDS.

|                                                                                                                                         |               |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Amount contributed (for expenditure in the Barataria levee district by the board of commissioners, Buras levee district).....           | \$8, 000      |
| Amount contributed (for expenditure in the Barataria levee district by the board of commissioners, Lafourche Basin levee district)..... | 32, 000       |
|                                                                                                                                         | <hr/> 40, 000 |
| Amount covered by uncompleted contracts.....                                                                                            | 32, 000       |
|                                                                                                                                         | <hr/> 8, 000  |
| July 1, 1918, balance available.....                                                                                                    | 8, 000        |

#### (e) Homochitto levee district.

*Location and description.*—The Homochitto levee district extends on the left bank from the mouth of the Yazoo River, 559 miles below Cairo, to Baton Rouge, 834 miles below Cairo, with a river frontage of 234 miles and an area of 233 square miles. There is no continuous levee line, several disconnected short levees exist, and loops are built at Rodney to Coles Creek, 659 to 666 miles below Cairo; Palmetto Point, 745 to 752 miles below Cairo; Angola State Farm, 764 to 770 miles below Cairo; and Bayou Sara, 800 miles below Cairo. The total length of these levees is 39.77 miles.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The levees were all built by property owners previous to 1912.

*Previous project.*—No project for work by the United States existed previous to 1912. In 1912 and 1913 the project adopted by the Mississippi River Commission was to rebuild levees damaged by the flood of 1912. This project was completed in 1912.

*Existing project.*—None.

*Operations and results during fiscal year.*—None.

*Conditions at end of fiscal year.*—There is no continuous levee line. There are several small detached levee systems constructed by private parties for their own protection. The total length of these levee lines is 39.77 miles.

*Local cooperation.*—The levees have been built and maintained by the property owners. No record of their cost is available.

*Terminal facilities.*—This district has the usual steamboat landings at which steamers plying on the Mississippi River land, principally to receive bulky freight such as cotton and cotton seed, but it is also served by several railroads which receive freight, principally cotton, and bring merchandise for local consumption. The physical connection between the railroads and the landing places is by means of teams hauling from the interior over earth roads

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Part of cost of levee-building machine, etc., included.

<sup>3</sup> Exclusive of available fund.

to the steamboat landings. There are no roads paralleling the river. These landings have warehouses of an elementary character for sheltering the merchandise received and shipped. The following places are served by steamboats only:

Bruinsburg, Miss. (644 L.).  
 Rodney, Miss. (652 L.).  
 Ashland, Miss. (661 L.)  
 Port Hudson, La. (810 L.).

The following places are served by steamboats and by the Louisiana Railway & Navigation Co.:

Angola, La. (764 L.).  
 Wilhelm, La. (773.5 L.).  
 Bayou Sara, La. (800 L.). Also by Yazoo & Mississippi Valley Railroad Co.  
 Baton Rouge, La. (834 L.).

Baton Rouge, La., is also served by Yazoo & Mississippi Valley Railroad Co., Baton Rouge, Hammond & Eastern Railroad, Southern Pacific Railroad, and the Frisco Railroad. In addition to the railroad facilities indicated above, the Southern Pacific Railroad and the Frisco Railroad also operate transfers for passenger and freight trains between North Baton Rouge, La. (834 L.), and Anchorage, La. (833 R.).

*Effect of improvement.*—The effect of the improvement already made is to give as large a measure of protection as the value of the lands behind the levees will justify.

*Proposed operations.*—None.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$2,576:

|                                       |            |
|---------------------------------------|------------|
| New work                              | \$2,501.22 |
| Maintenance                           | 74.78      |
| Net total expended                    | 2,576.00   |
| Total appropriations to June 30, 1918 | 3,000.00   |

| Fiscal year ending June 30.           | 1910       | 1912   | 1918    |
|---------------------------------------|------------|--------|---------|
| Expended for new work <sup>1</sup>    | \$2,501.22 |        |         |
| Expended for maintenance <sup>1</sup> |            | \$5.07 |         |
| Total expended <sup>1</sup>           | 2,501.22   | 5.07   | \$69.71 |
| Appropriated or allotted              | 3,000.00   |        |         |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                                |          |
|--------------------------------------------------------------------------------|----------|
| July 1, 1917, balance unexpended                                               | \$493.71 |
| June 30, 1918, amount expended during fiscal year <sup>1</sup> for maintenance | 69.71    |
| July 1, 1918, balance unexpended                                               | 424.00   |
| July 1, 1918, balance available                                                | 424.00   |

#### (f) Pontchartrain levee district.

*Location and description.*—The Pontchartrain levee district extends on the left bank from the lower limits of Baton Rouge, 834 miles below Cairo, to New

<sup>1</sup> Not deducting receipts from sales, etc.

Orleans, 957.5 miles below Cairo, with a river frontage of 123.5 miles. The levee line is continuous and is 125.55 miles in length. The Pontchartrain and Lake Borgne levee districts comprise the same basin, which has a total area of 1,816 square miles.

*Original condition.*—Originally, there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to a grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, land slope one on three to 8 feet below crown, and thence a banquette of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract, and by hired labor, 1,240,820.37 cubic yards, at a total cost of \$176,607.02.

Total work done by the United States and local authorities is as follows:

|                                       |               |             |
|---------------------------------------|---------------|-------------|
| Constructed by the United States..... | cubic yards.. | 1, 240, 820 |
| Constructed by local authorities..... | do.....       | 578, 221    |
| Total constructed during year.....    | do.....       | 1, 819, 041 |
| Work done by the United States.....   | per cent..    | 68. 2       |

The completed levee line is 18.90 in length.

The work under construction and the progress thereon is shown in the following tables and has resulted in increased protection against floods:

| Name of levee.            | Character of work.      | Miles below Cairo. | Length.      | Average height. | In contract.        |
|---------------------------|-------------------------|--------------------|--------------|-----------------|---------------------|
|                           |                         |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Ben Hur to Burtville..... | New and enlargement.... | 845-7 L.           | 12, 189      | 18. 1           | 436, 540. 57        |
| Towles.....               | do.....                 | 850-3 L.           | 12, 918      | 18. 0           | 412, 930. 03        |
| Golden Gate-Oakley.....   | do.....                 | 860-2 L.           | 19, 474      | 18. 5           | 450, 000. 00        |
| Nita.....                 | Enlargement.....        | 902- L.            | 6, 242       | 16. 0           | 129, 561. 30        |
| Dieharry.....             | do.....                 | 888- L.            | 21, 238      | 20. 5           | 192, 223. 00        |
| Reserve.....              | New.....                | 925- L.            | 2, 174       | 14. 0           | 102, 491. 47        |
| Total.....                |                         |                    |              |                 | 1, 723, 746. 37     |

| Name of levee.            | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.                      | Required to complete. |
|---------------------------|---------------------|-----------------------|-----------------------|----------------------------|-----------------------|
|                           | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |                            | <i>Cubic yards.</i>   |
| Ben Hur to Burtville..... | 426, 612. 57        | 426, 612. 57          | 8. 37                 | <sup>1</sup> \$35, 745. 06 |                       |
| Towles.....               | 412, 930. 03        | 412, 930. 03          | 12. 7                 | 52, 442. 11                |                       |
| Golden Gate-Oakley.....   |                     |                       | 9. 45                 |                            | 450, 000. 00          |
| Nita.....                 | 129, 561. 30        | 129, 561. 30          | 12. 00                | 15, 547. 34                |                       |
| Dieharry.....             | 169, 225. 00        | 169, 225. 00          | 19. 34                | <sup>1</sup> 32, 730. 15   | 22, 998. 00           |
| Reserve.....              | 102, 491. 47        | 102, 491. 47          | 12. 89                | 13, 215. 83                |                       |
| Total.....                | 1, 240, 820. 37     | 1, 240, 820. 37       |                       | 149, 680. 49               | 472, 998. 00          |

<sup>1</sup> Field cost by hired labor and Government plant.

The following work was done by hired labor:

Shannon (838-L.), 2,810 cubic yards were replaced in slide, at a cost of \$715.

Southwood (876-L.), slide was cut out and earth restored at a cost of \$7,177.96.

Work was done by hired labor and with Government plant as follows:

| Machine and location.          | Mobilization. | Clearing.  | Plowing. | Operation.  | Repairs.   | Dressing.  | Sodding. |
|--------------------------------|---------------|------------|----------|-------------|------------|------------|----------|
| B-3, Ben Hur to Burtville..... | \$1,850.00    | \$1,043.47 | \$354.75 | \$26,191.59 | \$1,886.25 | \$4,089.00 | 234.00   |
| B-2 and B-6, Dicharry.....     | 3,531.68      | 415.90     | 251.25   | 22,865.89   | 2,964.54   | 2,452.09   | 184.00   |
| B-3, Reserve.....              | 3,360.71      | 134.46     | 73.50    | 7,728.13    | 854.00     | 922.43     | 104.00   |

| Machine and location.          | Surveys. | Depreciation. | Overhead.  | Total cost. | Yards handled. | Cost per cubic yard. |
|--------------------------------|----------|---------------|------------|-------------|----------------|----------------------|
| B-3, Ben Hur to Burtville..... | \$96.00  | \$6,175.00    | \$1,976.59 | \$43,896.59 | 426,612.50     | \$10.29              |
| B-2 and B-6, Dicharry.....     | 64.80    | 11,761.00     | 3,000.00   | 47,498.15   | 169,225.00     | 28.06                |
| B-3, Reserve.....              | 28.60    | 3,030.00      | 977.00     | 17,222.83   | 102,491.47     | 16.80                |

Work on various levees was commenced and finished as follows:

| Name of levee.            | Miles below Cairo. | Work commenced. | Work finished. | Remarks.       |
|---------------------------|--------------------|-----------------|----------------|----------------|
| Ben Hur to Burtville..... | 845-47 L.          | Mar. 16, 1917   | Nov. 8, 1917   | Not commenced. |
| Towles.....               | 850-53 L.          | June 6, 1917    | Jan. 9, 1918   |                |
| Golden Gate-Oakley.....   | 860-62 L.          |                 |                |                |
| Nita.....                 | 902 L.             | Oct. 29, 1917   | Mar. 2, 1918   | Not completed. |
| Dicharry.....             | 888 L.             | Feb. 5, 1918    |                |                |
| Reserve.....              | 925 L.             | Dec. 4, 1917    | Jan. 26, 1918  |                |

*Contracts in force.*

| Name of contractor.     | Amount of work. | Character of work.   | Unit price. | Date of approval. | Date of beginning. | Date of expiration. | Name of levee.                  |
|-------------------------|-----------------|----------------------|-------------|-------------------|--------------------|---------------------|---------------------------------|
| Grasser Contracting Co. | \$33,000        | New and enlargement. | Cents. 9.45 | 1917<br>Dec. 1    | 1917<br>Dec. 21    | 1918<br>Dec. 31     | Golden Gate-Oakley (860-62 L.). |

*Condition at end of fiscal year.*—The following is the condition of the levees at the end of the fiscal year (June 30, 1918):

|                                                                                                                                        |                         |              |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------|
| Project for earthwork is.....                                                                                                          | per cent completed..... | 73.7         |
| Miles in system.....                                                                                                                   |                         | 125.35       |
| Miles built.....                                                                                                                       |                         | 125.35       |
| Yardage lost during the year.....                                                                                                      | cubic yards.....        | 538 741      |
| Contents of levees (June 30, 1918).....                                                                                                | do.....                 | 23, 705, 806 |
| Required to bring levees to grade and section.....                                                                                     | do.....                 | 8, 463, 358  |
| Required to bring levees to grade and section and to construct new levees, which will become necessary within the next five years..... | cubic yards.....        | 9, 279, 700  |
| Miles of levee above highest water—                                                                                                    |                         |              |
| Less than 1 foot.....                                                                                                                  |                         | None.        |
| From 1 to 2 feet.....                                                                                                                  |                         | 11.36        |
| From 2 to 3 feet.....                                                                                                                  |                         | 57.26        |
| From 3 to 4 feet.....                                                                                                                  |                         | 17.40        |
| From 4 to 5 feet.....                                                                                                                  |                         | None.        |
| Miles of levee up to grade but deficient in section.....                                                                               |                         | 20.43        |
| Miles of levee up to full grade and section.....                                                                                       |                         | 18.90        |

*Local cooperation.*—Local authorities have expended, in part and between 1882 and January 1, 1918, \$4,609,914.34 in building, improving, and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been dis-

covered. Under conditions of the flood-control bill (H. R. 14777 64th Cong.), requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission" the Pontchartrain Levee Board has contributed for work under existing project \$40,000.

*Terminal facilities.*—This district has landing places at every plantation for steamboats plying on the Mississippi River to discharge merchandise for local consumption and to receive freight. These places are served immediately in the rear by the Yazoo & Mississippi Valley Railroad. A limited mileage of good roads paralleling the river is being constructed. On the whole the district has poorly kept earth roads. The physical connection between these landing places and the railroad is by means of teams hauling over earth roads and ramps over the levees and graded approaches to the landing places at the water's edge. There are at the following landings warehouses of an elementary character for the purpose of sheltering freight received and shipped:

Burtville, La. (848 L.).  
 St. Gabriel, La. (862.5 L.).  
 Geismar, La. (882 L.).  
 Darrow, La. (889 L.).  
 Burnside, La. (894 L.).  
 Convent, La. (905 L.).  
 Lutcher, La. (916 L.).  
 Gareyville, La. (924 L.).  
 Reserve, La. (926 L.).  
 Kenner, La. (951 L.).  
 Harahan, La. (956 L.).

There is deep water as far as the mouth of Red River. The water terminals at Baton Rouge, La. (844 L.), where the Standard Oil Co. of Louisiana's plant is located, and at Grammercy, La. (917 L.), where is located the sugar refinery of the Grammercy Co., which refines sugar in transit for export, and also at Good Hope, La. (938 L.), and at Destrehan, La. (956 L.), where are located oil companies engaged in the oil export business, are places which have substantially built landing places where seagoing steamers discharge and receive cargoes.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. Complete protection is not yet afforded and delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section, adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$2,388,268.29:

|             |                |
|-------------|----------------|
| New work    | \$2,204,705.07 |
| Maintenance | 183,563.22     |

|                    |              |
|--------------------|--------------|
| Net total expended | 2,388,268.29 |
|--------------------|--------------|

|                                       |              |
|---------------------------------------|--------------|
| Total appropriations to June 30, 1918 | 2,412,008.02 |
|---------------------------------------|--------------|

| Fiscal year ending June 30.           | 1914         | 1915        | 1916        | 1917        | 1918         |
|---------------------------------------|--------------|-------------|-------------|-------------|--------------|
| Expended for new work <sup>1</sup>    | \$102,384.34 | \$54,677.25 | \$38,815.07 |             | \$142,708.83 |
| Expended for maintenance <sup>1</sup> | 616.33       |             | 14,461.00   | \$87,272.88 | 12,552.06    |
| Total expended <sup>1</sup>           | 103,000.67   | 54,677.25   | 53,276.07   | 87,272.88   | 155,261.49   |
| Appropriated or allotted              | 100,000.00   | 45,000.00   | 125,000.00  | 81,878.41   |              |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                    |                  |
|--------------------------------------------------------------------|------------------|
| July 1, 1917, balance unexpended.....                              | \$96,122.81      |
| Amount appropriated by sundry civil act approved June 12, 1917.... | 81,878.41        |
| Receipts from sales, etc., during fiscal year 1918.....            | 1,742.84         |
|                                                                    | <hr/> 179,744.06 |

|                                                                 |                  |
|-----------------------------------------------------------------|------------------|
| June 30, 1918, amount expended during fiscal year: <sup>1</sup> |                  |
| For new work.....                                               | \$142,708.83     |
| For maintenance.....                                            | 12,552.66        |
|                                                                 | <hr/> 155,261.49 |

|                                                            |           |
|------------------------------------------------------------|-----------|
| July 1, 1918, balance unexpended.....                      | 24,482.57 |
| July 1, 1918, amount covered by uncompleted contracts..... | 24,482.57 |

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920.....        | <sup>2</sup> Indeterminate. |

*Funds contributed for improvement of Mississippi River in Pontchartrain levee district.*

#### SPECIAL FUNDS.

|                                                                                                                                        |          |
|----------------------------------------------------------------------------------------------------------------------------------------|----------|
| Amount contributed for expenditure in the Pontchartrain levee district by the board of commissioners, Pontchartrain levee district.... | \$40,000 |
| Amount covered by uncompleted contracts.....                                                                                           | 40,000   |

#### (g) Lake Borgne levee district.

*Location.*—The Lake Borgne levee district extends on the left bank from the lower limits of New Orleans, 973 miles below Cairo, to the Head of the Passes, 1,064 miles below Cairo, with a river frontage of 91 miles. The levee line is continuous to a point about 14 miles above the Head of the Passes, a length of 9.29 miles. The Lake Borgne and Pontchartrain levee district comprise the same basin, which has a total area of 1,816 square miles.

*Original condition.*—Originally there were no levees and the country was subject to overflow. The first levees were built by riparian owners under a Spanish law which required each riparian owner to build a levee. Gradually the work was taken over by the State authorities. The flood of 1882 caused many crevasses and practically destroyed the old levee line.

*Previous projects.*—None.

*Existing project.*—The present project is to build and enlarge the levees to grade and section sufficient to protect the basin against overflow. This project was adopted in 1882. It has been modified from time to time and at present contemplates the enlargement of the existing levee line in cooperation with the State and local levee boards to a grade 3 feet above the deduced confined flood of 1912, with a section having a crown of 8 feet width, river slope one on three, land slope one on three to 8 feet below crown, and thence a banquettes of varying widths from 20 to 40 feet, dependent on the height of the levee.

*Operations and results during the fiscal year.*—There has been added during the year, under contract and by hired labor, 176,782 cubic yards, at a total cost of \$32,441.97.

The total work done by the United States and local authorities is as follows:

|                                       |               |         |
|---------------------------------------|---------------|---------|
| Constructed by the United States..... | cubic yards.. | 176,782 |
| Constructed by local authorities..... | do.....       | 167,863 |

|                                        |            |         |
|----------------------------------------|------------|---------|
| Total constructed during the year..... | do.....    | 344,645 |
| Work done by the United States.....    | per cent.. | 51.29   |

The effect has been to give increased security against floods. The completed levee line is 47.92 miles in length.

The work under construction and the progress thereon is shown in the following tables and has resulted in increased protection against floods:

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

| Name of levee.         | Kind of work.            | Miles below Cairo. | Length.      | Average height. | In contract.        |
|------------------------|--------------------------|--------------------|--------------|-----------------|---------------------|
|                        |                          |                    | <i>Feet.</i> | <i>Feet.</i>    | <i>Cubic yards.</i> |
| Kenilworth.....        | New and enlargement..... | 983 L.             | 5,049        | 13.0            | 58,767.53           |
| Scarsdale.....         | do.....                  | 988-90 L.          | 8,669        | 12.5            | 78,426.00           |
| Burbridge.....         | do.....                  | 1,000-2 L.         | 11,316       | 9.1             | 70,015.00           |
| Harlem to Savoie.....  | Enlargement.....         | 1,008-10 L.        | 18,544       | 10.0            | 94,858.00           |
| Martin to Bohemia..... | New and enlargement..... | 1,015 L.           | 4,630        | 8.1             | 18,826.00           |
| Fort St. Philip.....   |                          | 1,041 L.           | 5,383        | 5.8             | 25,100.00           |
| Total.....             |                          |                    |              |                 | 345,992.53          |

| Name of levee.         | Placed during year. | Paid for during year. | Price per cubic yard. | Cost.                  | Required to complete. |
|------------------------|---------------------|-----------------------|-----------------------|------------------------|-----------------------|
|                        | <i>Cubic yards.</i> | <i>Cubic yards.</i>   | <i>Cents.</i>         |                        | <i>Cubic yards.</i>   |
| Kenilworth.....        | 47,510              | 41,902.25             | 15.4                  | \$6,452.95             | 11,257.53             |
| Scarsdale.....         | 78,426              | 78,426.00             | 15.99                 | <sup>1</sup> 12,545.30 |                       |
| Burbridge.....         | 36,946              | 36,946.00             | 15.42                 | <sup>1</sup> 5,699.00  |                       |
| Harlem to Savoie.....  |                     |                       | 15.4                  |                        | 94,858.00             |
| Martin to Bohemia..... |                     |                       | 19.94                 |                        | 18,826.00             |
| Fort St. Philip.....   | 13,900              | 13,900.00             | 30.48                 | <sup>1</sup> 4,236.72  | ( <sup>2</sup> )      |
| Total.....             | 176,782             | 171,174.25            |                       | 28,933.97              |                       |

<sup>1</sup> Cost by hired labor.<sup>2</sup> Average cost for completed work, 16.27. cents per cu. yd.*Cost of construction of wooden revetments.*

|                                  | Linear feet. | Cost.      |
|----------------------------------|--------------|------------|
| Scarsdale, wooden revetment..... | 1,472        | \$2,250.32 |
| Burbridge, wooden revetment..... | 6,300        | 8,567.05   |

Work was done by hired labor and with Government plant, as follows:

| Machine and location.     | Mobilization. | Clearing. | Drain- ing. | Plow- ing. | Opera- tion. | Repairs.   | Dress- ing. |
|---------------------------|---------------|-----------|-------------|------------|--------------|------------|-------------|
| B-1, Scarsdale.....       | \$532.00      | \$296.00  | \$34.56     | \$84.00    | \$9,216.44   | \$1,193.50 | \$1,035.00  |
| B-1, Burbridge.....       | 636.00        | 155.10    |             | 67.00      | 3,793.08     | 442.92     | 556.22      |
| B-1, Fort St. Philip..... | 416.52        | 88.00     |             | 36.00      | 3,138.34     | 517.06     |             |

| Machine and location.     | Sodding. | Surveys. | Depre- ciation. | Over- head. | Total cost. | Handled.      | Cost per yard. |
|---------------------------|----------|----------|-----------------|-------------|-------------|---------------|----------------|
|                           |          |          |                 |             |             | <i>Yards.</i> |                |
| B-1, Scarsdale.....       | \$94.80  | \$68.00  | \$1,545.00      | \$448.00    | \$14,539.30 | 78,426        | \$0.1854       |
| B-1, Burbridge.....       | 24.50    | 24.18    | 773.00          | 215.00      | 6,687.00    | 36,946        | .1899          |
| B-1, Fort St. Philip..... | 24.80    | 16.00    | 400.00          | 126.00      | 4,762.72    | 13,900        | .3426          |

Work on various levees was commenced and finished as follows:

| Name of levee.                 | Miles below Cairo. | Work commenced. | Work finished. | Remarks.               |
|--------------------------------|--------------------|-----------------|----------------|------------------------|
| Kenilworth.....                | 983 L.             | May 3, 1918     |                | Under construction.    |
| Scarsdale.....                 | 988-90 L.          | Aug. 11, 1917   | Nov. 11, 1917  |                        |
| Scarsdale, wood revetment..... | 990 L.             | Feb. 5, 1918    | Mar. 1, 1918   |                        |
| Burbridge.....                 | 1,000-2 L.         | June 15, 1916   | Aug. 10, 1917  | Work not begun.<br>Do. |
| Burbridge, wood revetment..... | 1,000-2 L.         | Feb. 24, 1918   | Apr. 5, 1918   |                        |
| Harlem to Savoie.....          | 1,008-10 L.        |                 |                |                        |
| Martin to Bohemia.....         | 1,015 L.           |                 |                |                        |
| Fort St. Philip.....           | 1,041 L.           | May 18, 1917    | June 24, 1917  |                        |

*Contracts in force.*

| Name of contractor.     | Amount of work. | Character of work.       | Unit prices. | Date of approval. |
|-------------------------|-----------------|--------------------------|--------------|-------------------|
| ester F. Alexander..... | 58,768          | Enlargement and new..... | Cents. 15.4  | 1917. Dec. 1      |
| Do.....                 | 94,918          | Enlargement.....         | 15.4         | Do.               |
| Do.....                 | 18,826          | do.....                  | 19.94        | Do.               |

| Name of contractor.     | Date of beginning. | Date of expiration. | Completed.   | Name of levee.      | Miles below Cairo. |
|-------------------------|--------------------|---------------------|--------------|---------------------|--------------------|
| ester F. Alexander..... | 1918. Jan. 15      | 1918. Dec. 31       | Per ct. 80.8 | Kenilworth.....     | 983 L.             |
| Do.....                 | do.                | do.                 | 100.0        | Harlem-Savoie.....  | 1,008-10 L.        |
| Do.....                 | do.                | do.                 | 109.0        | Martin-Bohemia..... | 1,015 L.           |

*Conditions at end of fiscal year.*—The following is the condition of the levees at the end of the fiscal year (June 30, 1918):

|                                                                                                                                                 |                         |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|
| Project for earthwork.....                                                                                                                      | per cent completed..... | 90.2      |
| Miles in system.....                                                                                                                            |                         | 78.13     |
| Miles built.....                                                                                                                                |                         | 78.13     |
| Yardage lost by abandoning old levees.....                                                                                                      | cubic yards.....        | 178,430   |
| Contents of levees (June 30, 1918).....                                                                                                         | do.....                 | 5,766,387 |
| Required to bring levees to grade and section.....                                                                                              | do.....                 | 626,369   |
| Required to bring levees to grade and section and to construct new levees which will become necessary within the next 5 years, cubic yards..... |                         | 838,785   |
| Miles of levees above highest water:                                                                                                            |                         |           |
| Less than 1 foot.....                                                                                                                           |                         | None.     |
| From 1 to 2 feet.....                                                                                                                           |                         | 8.78      |
| From 2 to 3 feet.....                                                                                                                           |                         | 15.41     |
| From 3 to 4 feet.....                                                                                                                           |                         | 2.99      |
| Miles of levee up to full grade but deficient in section.....                                                                                   |                         | 3.03      |
| Miles of levee up to full grade and section.....                                                                                                |                         | 47.92     |

*Local cooperation.*—Local authorities have expended between 1882 and January 1, 1918, \$1,928,439.55 in building, improving and maintaining the levee line. Other expenditures since 1882, and heavy ones previous thereto, are known to have been made, but no accurate record of them has been discovered. Under conditions of the flood-control bill (H. R. 14777, 64th Cong.), requiring local interests to contribute "not less than one-half of such sum as may have been allotted by the commission," the Lake Borgne Levee Board has contributed \$25 000 for work under existing project.

*Terminal facilities.*—None.

*Effect of improvement.*—The effect of the work has been to give added protection against floods. Complete protection is not yet afforded and delay may cause serious damage.

*Proposed operations.*—It is proposed to continue to strengthen the levee line by enlarging weak and low levees to the approved grade and section adopted by the Mississippi River Commission, building new levees to replace those threatened by caving banks, and making minor repairs where necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$772,630.45:

|                   |                |
|-------------------|----------------|
| New work .....    | \$692, 474. 17 |
| Maintenance ..... | 80, 156. 28    |

|                          |              |
|--------------------------|--------------|
| Net total expended ..... | 772, 630. 45 |
|--------------------------|--------------|

|                                             |              |
|---------------------------------------------|--------------|
| Total appropriations to June 30, 1918 ..... | 822, 868. 15 |
|---------------------------------------------|--------------|

| Fiscal year ending June 30.                 | 1914          | 1915          | 1916          | 1917          | 1918          |
|---------------------------------------------|---------------|---------------|---------------|---------------|---------------|
| Expended for new work <sup>1</sup> .....    | \$86, 591. 66 | \$45, 128. 80 | \$51, 291. 74 | \$28, 338. 48 | \$19, 953. 17 |
| Expended for maintenance <sup>1</sup> ..... | 2, 468. 77    |               | 8, 030. 58    |               | 17, 301. 14   |
| Total expended <sup>1</sup> .....           | 89, 060. 43   | 45, 128. 80   | 59, 322. 32   | 28, 338. 48   | 37, 254. 31   |
| Appropriated or allotted .....              | 75, 000. 00   | 40, 000. 00   | 50, 000. 00   | 50, 468. 15   |               |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                                                   |               |
|-------------------------------------------------------------------|---------------|
| July 1, 1917, balance unexpended .....                            | \$37, 023. 86 |
| Amount appropriated by sundry civil act approved June 12, 1917 .. | 50, 468. 15   |

87, 492. 01

June 30, 1918, amount expended during fiscal year: <sup>1</sup>

|                       |               |
|-----------------------|---------------|
| For new work .....    | \$19, 953. 17 |
| For maintenance ..... | 17, 301. 14   |

37, 254. 31

|                                        |             |
|----------------------------------------|-------------|
| July 1, 1918, balance unexpended ..... | 50, 237. 70 |
|----------------------------------------|-------------|

|                                             |         |
|---------------------------------------------|---------|
| July 1, 1918, outstanding liabilities ..... | 134. 18 |
|---------------------------------------------|---------|

|                                                          |             |
|----------------------------------------------------------|-------------|
| July 1, 1918, amount covered by uncompleted contracts .. | 25, 989. 70 |
|----------------------------------------------------------|-------------|

26, 123. 88

|                                                       |             |
|-------------------------------------------------------|-------------|
| July 1, 1918, balance available for maintenance ..... | 24, 113. 82 |
|-------------------------------------------------------|-------------|

|                                                             |             |
|-------------------------------------------------------------|-------------|
| Amount available for fiscal year ending June 30, 1919 ..... | 24, 113. 82 |
|-------------------------------------------------------------|-------------|

|                                                                                         |                             |
|-----------------------------------------------------------------------------------------|-----------------------------|
| Amount (estimated) required to be appropriated for completion of existing project ..... | <sup>2</sup> Indeterminate. |
|-----------------------------------------------------------------------------------------|-----------------------------|

|                                                                                  |                             |
|----------------------------------------------------------------------------------|-----------------------------|
| Amount that can be profitably expended in fiscal year ending June 30, 1920 ..... | <sup>2</sup> Indeterminate. |
|----------------------------------------------------------------------------------|-----------------------------|

*Funds contributed for improvement of Mississippi River in Lake Borgne levee district.*

## SPECIAL FUNDS.

|                                                                                                                                     |           |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Amount contributed (for expenditure in Lake Borgne levee district, by board of commissioners Lake Borgne Basin levee district ..... | \$25, 000 |
| Amount covered by uncompleted contracts and levee work and reetment to be done by hired labor .....                                 | 25, 000   |

## III. SURVEYS.

*Location and description.*—Surveys are made wherever required throughout the limits of the district.

*Original condition.*—Lack of surveys made data for studies of the river incomplete.

*Previous projects.*—None.

*Existing project.*—The project adopted by the Mississippi River Commission in 1884 provides for an annual survey, at the lowest river stage, of each locality where work is in progress. In 1888 the project was amplified to include surveys

<sup>1</sup> Not deducting receipts from sales, etc.

<sup>2</sup> Exclusive of available funds.

caving banks wherever important interests are threatened. Except for New Orleans Harbor, surveys of works are included in the cost of the works and reported therein. Special surveys are made, as ordered, from time to time by the Mississippi River Commission.

*Operations and results during the fiscal year.*—Surveys have been made of caving banks at Oak and Newtown Bends, Diamond Island Bend, Lake Palmyra, and at Yucatan Bend; also of caving banks between Natchez and Red River Landing. The same survey parties also made surveys of the several localities at which revetment work has been done. A special survey of a shoal crossing at Brusle, La., below Baton Rouge, was made. The expenditures amounted to \$8,869.08.

*Condition at end of year.*—All required surveys have been made during the year except in parts of New Orleans Harbor. The constant changing of the banks and bed of the river necessitates the steady work of two survey parties.

*Local cooperation.*—There is no local cooperation in making surveys. The maps and records of the Board of State Engineers of Louisiana are placed at the disposal of the United States whenever information therefrom is desired.

*Terminal facilities.*—None.

*Effect of improvement.*—The surveys made during past years and the present year furnish valuable data for the study of the river at definite localities and for making plans for improvements at these localities.

*Proposed operations.*—It is proposed to continue work under the present project, making annual surveys of each revetment and such other surveys as may become necessary.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$164,187.46:

|                                       |                         |
|---------------------------------------|-------------------------|
| New work                              | \$25,201.37             |
| Maintenance                           | 138,986.09              |
| Net total expended                    | 164,187.46              |
| Total appropriations to June 30, 1918 | <sup>1</sup> 165,391.06 |

| Fiscal year ending June 30.           | 1914     | 1915     | 1916     | 1917       | 1918       |
|---------------------------------------|----------|----------|----------|------------|------------|
| Expended for new work <sup>2</sup>    | \$148.68 | \$744.45 | \$741.00 |            |            |
| Expended for maintenance <sup>2</sup> | 3,640.54 | 4,840.06 | 666.19   | \$3,111.04 | \$8,869.08 |
| Total expended <sup>3</sup>           | 3,789.22 | 5,584.51 | 1,407.19 | 3,111.04   | 8,869.08   |
| Appropriated or allotted              |          | 8,000.00 | 5,000.00 | 5,459.01   |            |

<sup>1</sup> Total amount, \$168,596.15; \$3,205.09 transferred to first and second Mississippi River districts.

<sup>2</sup> Not deducting receipts from sales, etc.

|                                                                                        |                             |
|----------------------------------------------------------------------------------------|-----------------------------|
| July 1, 1917, balance unexpended.....                                                  | \$7, 818. 76                |
| Amount appropriated by sundry civil act approved June 12, 1917.....                    | 5, 459. 01                  |
| Receipts from sales, etc., during fiscal year 1918.....                                | 10. 25                      |
|                                                                                        | 13, 288. 02                 |
| Deduction on account of transfer to first and second Mississippi River district.....   | 3, 205. 09                  |
|                                                                                        | 10, 082. 93                 |
| June 30, 1918, amount expended during fiscal year for maintenance <sup>1</sup> .....   | 8, 869. 08                  |
| July 1, 1918, balance unexpended.....                                                  | 1, 213. 85                  |
| July 1, 1918, outstanding liabilities.....                                             | 857. 63                     |
| July 1, 1918, balance available for maintenance.....                                   | 356. 22                     |
| Amount available for fiscal year ending June 30, 1919.....                             | 356. 22                     |
| Amount (estimated) required to be appropriated for completion of existing project..... | <sup>2</sup> Indeterminate. |
| Amount that can be profitably expended in fiscal year ending June 30, 1920.....        | <sup>2</sup> Indeterminate. |

## IV. PLANT.

(a) *Revetment plant.*

*Location and description.*—At New Orleans, La., and Natchez, Miss., respectively, 965 and 700 miles below Cairo.

*Original condition.*—None.

*Previous projects.*—None.

*Existing project.*—Adopted in 1894, provides for the construction of such new plant as may be required from time to time, and for the repair, maintenance, and care of the plant on hand.

*Operations and results during fiscal year.*—At date of last annual report the floating plant of the district consisted of 117 large pieces, exclusive of docks, lighters, gasoline launches, pontoons, skiffs, etc. During the year 6 standard barges and 1 quarter boat were built and 1 levee-building machine was assembled for the district. In addition 10 barges and 1 derrick hull were constructed for work at the mouth of the Mississippi, and 2 searchlight barges were framed and creosoted for the Panama Canal. All of the construction was done at the engineer depot by hired labor.

Operations of the creosoting plant for the year shows the following totals: Lumber treated, 171,620 cubic feet; pounds of oil used, 2,422,272; value of creosote used, \$64,124.92. The plant was operated for 126 days, during which 63 charges were treated.

*Government switch.*—During the year 165 cars have been received, comprising 73 of lumber, 10 of coal, 5 of wire and nails, 2 of rope, 4 of machinery, 4 of iron, 54 of earth filling, and 13 of creosote oil.

The existing plant has been repaired and cared for at the United States engineer depot at New Orleans, La., and at Natchez, Miss. All necessary repairs have been made to boats, graders, quarter boats, etc., and the plant placed in good working condition, the work being done by hired labor.

*Care of plant.*—This includes such items as fire protection, electric light service, watchmen, putting out and taking in spars, mooring lines, etc., operating pump boat, steamboat expenses, issuing and storing property, proportion of general supervision and incidental expenses, and has amounted to about \$86.52 for each large piece of plant. The cost is increased by the fact that the plant is cared for at two widely separated localities, New Orleans, La., and Natchez, Miss., necessitating a duplication of some of the charges.

Supt. R. H. Bolen was in charge at the engineer depot of the construction, repair, and care of plant, under the general direction of Assistant Engineer H. S. Douglas.

<sup>1</sup> Not deducting receipts from sales, etc.<sup>2</sup> Exclusive of available funds.

The expenditures during the year were \$134,135.96, distributed as follows:

|                               |             |
|-------------------------------|-------------|
| New plant                     | \$16,197.38 |
| Repairs to plant              | 42,223.37   |
| Cost of plant                 | 10,729.16   |
| Administration                | 1,610.71    |
| Work done for other districts | 62,275.71   |
| Miscellaneous                 | 1,099.63    |
| Total                         | 134,135.96  |

*Condition at end of fiscal year.*—A floating plant, consisting of 124 large pieces for bank revetment, levee construction, and dredging, has been acquired. A fairly complete engineer depot on the river front at New Orleans has been secured. A warehouse, a combined machine, blacksmith, and carpenter shop have been built and a creosoting plant has been installed. Other equipment necessary for building new plant and repairing that on hand has been acquired. Suitable railroad tracks have been built and connected with the Public Belt Railway system of the city of New Orleans. The general condition of the plant is good. The project is not susceptible of completion, as new plant must be built from time to time and existing plant repaired, maintained, and cared for. The expenditures on existing project have been \$807,295.47 for new plant and \$668,839.40 for maintenance, making a total of \$1,476,134.87.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—Acquisition of the necessary plant to prosecute work by day labor and construct necessary revetments in caving bends between Vicksburg and New Orleans.

*Proposed operations.*—To repair, maintain, and care for the existing plant, and to construct such new plant as may be required.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

#### (b) *Levee plant.*

*Location and description.*—The general character of operations renders it impracticable to give data as to location and description.

*Original condition.*—None.

*Previous projects.*—None.

*Existing project.*—None.

*Operations and results during the fiscal year.*—The cost of maintenance has been absorbed in the cost of the work upon which the plant was engaged.

*Condition at end of fiscal year.*—All levee plant is in good condition except the levee-building machine B-2, which is now undergoing repairs. One locomotive crane levee-building machine of 160-foot radius, with quarterboat, barge, and equipment, was added to the plant at a cost of \$89,708.23. The plant has been operated to great advantage during the year and several additional machines are needed to realize the greatest economy in continuing the work. One locomotive crane of 125-foot radius is now under construction and two others of the same type, now being used in the third district, will be transferred to the district in the near future. Additional quarterboats, barges, and equipment will be necessary in order to carry on the work economically.

*Local cooperation.*—None.

*Terminal facilities.*—None.

*Effect of improvement.*—The introduction of Government-owned plant has cheapened the cost of levee work, especially below Red River, and added greatly to the safety of the levees during floods and reduced the cost of high-water protection.

*Proposed operations.*—Completion of 125-radius locomotive crane under initial contract, with quarterboat and equipment.

*Recommended modifications of project.*—None.

*References to published articles not previously reported.*—None.

*Commercial statistics.*—By resolution of the Mississippi River Commission of November 19, 1914, the secretary is charged with the duty to secure complete commercial statistics of the water-borne traffic on the Mississippi River.

*Appropriations.*—See current report of the Mississippi River Commission.

## FINANCIAL SUMMARY.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to \$1,476,134.87:

|             |                |
|-------------|----------------|
| New work    | \$807, 295. 47 |
| Maintenance | 668, 839. 40   |

|                    |                 |
|--------------------|-----------------|
| Net total expended | 1, 476, 134. 87 |
|--------------------|-----------------|

|                                       |                 |
|---------------------------------------|-----------------|
| Total appropriations to June 30, 1918 | 1, 538, 825. 48 |
|---------------------------------------|-----------------|

| Fiscal year ending June 30.           | 1914        | 1915        | 1916        | 1917        | 1918        |
|---------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expended for new work <sup>1</sup>    | \$44,058.02 | \$39,013.92 | \$30,006.93 | \$70,141.64 | \$16,197.38 |
| Expended for maintenance <sup>1</sup> | 8,908.76    | 67,917.96   | 70,679.22   | 61,006.40   | 55,662.87   |
| Total expended <sup>1</sup>           | 52,966.78   | 106,931.88  | 100,686.15  | 131,148.04  | 71,860.25   |
| Appropriated or allotted              | 60,000.00   | 105,000.00  | 160,000.00  | 76,925.43   |             |

<sup>1</sup> Not deducting receipts from sales, etc.

|                                  |               |
|----------------------------------|---------------|
| July 1, 1917, balance unexpended | \$28, 676. 91 |
|----------------------------------|---------------|

|                                                                |             |
|----------------------------------------------------------------|-------------|
| Amount appropriated by sundry civil act approved June 12, 1917 | 76, 325. 44 |
|----------------------------------------------------------------|-------------|

|                                                    |            |
|----------------------------------------------------|------------|
| Receipts from sales, etc., during fiscal year 1918 | 9, 948. 80 |
|----------------------------------------------------|------------|

|  |              |
|--|--------------|
|  | 114, 951. 15 |
|--|--------------|

June 30, 1918, amount expended during fiscal year:<sup>1</sup>

|              |               |
|--------------|---------------|
| For new work | \$16, 197. 38 |
|--------------|---------------|

|                 |             |
|-----------------|-------------|
| For maintenance | 55, 662. 87 |
|-----------------|-------------|

|  |                          |
|--|--------------------------|
|  | <sup>2</sup> 71, 860. 25 |
|--|--------------------------|

|                                  |                          |
|----------------------------------|--------------------------|
| July 1, 1918, balance unexpended | <sup>2</sup> 43, 090. 90 |
|----------------------------------|--------------------------|

|                                       |             |
|---------------------------------------|-------------|
| July 1, 1918, outstanding liabilities | 11, 925. 73 |
|---------------------------------------|-------------|

|                                                 |             |
|-------------------------------------------------|-------------|
| July 1, 1918, balance available for maintenance | 31, 165. 17 |
|-------------------------------------------------|-------------|

|                                                       |                          |
|-------------------------------------------------------|--------------------------|
| Amount available for fiscal year ending June 30, 1919 | <sup>2</sup> 31, 165. 17 |
|-------------------------------------------------------|--------------------------|

Amount (estimated) required to be appropriated for completion of existing project

<sup>3</sup> Indeterminate

Amount that can be profitably expended in fiscal year ending June

30, 1920, for new work

<sup>3</sup> Indeterminate

The following inclosures (maps) accompany and form part of this report:

1. Bondurant Chute, La.
2. Kempe Bend, La.
3. Natchez and Vidalia Harbors, Miss. and La.
4. Grand Bay, La.
5. Plaquemine Bend, La.
6. New Orleans Harbor, La.
7. Levee districts—Map fourth district.
8. Lower Tensas levee district profile.
9. Atchafalaya levee district profile.
10. Lafourche levee district profile.
11. Barataria levee district profile.
12. Pontchartrain levee district profile.
13. Lake Borgne levee district profile.

G. McC. DERRY,

Lieut. Col., U. S. Army, District Engineer.

<sup>1</sup> Not deducting receipts from sales, etc.

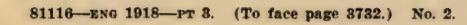
<sup>2</sup> \$6,366.39 due from other offices not included.

<sup>3</sup> Exclusive of available funds.





shed Comm  
Water 1916  
-"- 1912  
built by U.  
enlarged -  
built by Loc  
enlarged -



# MISSISSIPPI RIVER COMMISSION.

80 Miles

PLATE No 9.

## MISSISSIPPI RIVER COMMISSION FOURTH DISTRICT. AFALAYA LEVEES.

UNDER THE DIRECTION OF  
L. G. Mc C. Derby, U. S. Army.

Knobloch, Asst. Engineer.

Drawn by *E. B. J.* June 1918.

Traced by *J. M. A.* June 1918.

Scale of Feet

0 10 000' 20 000' 30 000' 40 000'

120 Miles

MODESTE.

DONALDSONVILLE  
88.6.2 Mls. Below CAIRO.

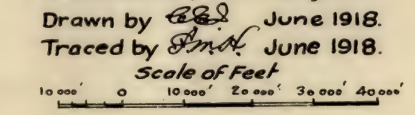
70'

60'

50'

40'

6500



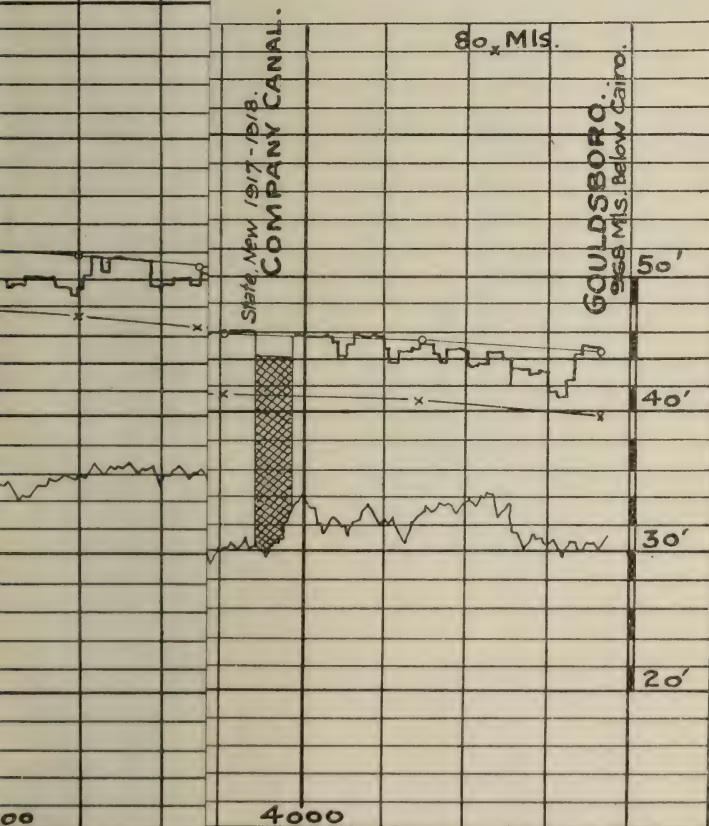
RIVER COMMISSION.  
H DISTRICT.  
**CHE LEVEES.**

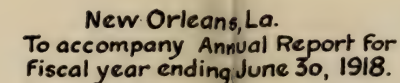
THE DIRECTION OF  
E C. Derby, U.S. Army.  
och, Asst. Engineer.

*E.C.D.* June 1918.  
June 1918.

Scale of Feet.  
10000' 20000' 30000' 40000'

LUDY





*Greene*  
Lieut. Col., U. S. Army.

MISSISSIPPI RIVER COMMISSION.  
FOURTH DISTRICT.

LAFOURCHE LEVEES.

UNDER THE DIRECTION OF

Lieut. Col. G. M<sup>rs</sup> C. Derby, U.S. Army.

W.E.Knobloch, Asst. Engineer.

Drawn by *C.B.* June 1918.

Traced by June 1918.

10000' 0 10000' 20000' 30000' 40000'

Established Commission Grade.  
Highest Water Level 1912.  
Levees built by U.S. 1917-1918.  
" " Enlarged " " " " "  
" " Built by Local Authorities 1917-1918.  
" " Enlarged " " " " "

London Bridge M&E  
1916-18 completely built  
SOCOLA CANAL.

PROPOSED CANAL  
PLAN

TO BE  
CONSTRUCTED  
AT  
SARATOGA LEVEL



0 Mis.

10 Mis.

20 Mis.

30 Mis.

ORLEANS PARISH LINE.  
882.5 Mis. below CAIRO.

Belle Chasse, New Camp, Dec. 1917.

CONCESSION

Live Oak, Enight camp, Feb. 1918.

Happy Point N. & E. 1917-1918. Under Contract.

MYRTLE GROVE.

Dear Range N. & E. 1917-1918. Under Construction.

State New camp, 1917-1918.

POINT CELESTE.

Magnolia N. & E. 1917-1918. Under Contract.

Long, Rideland, N. & E. 1917-1918. Under Contract.

New Orleans, La.

To accompany Annual Report for  
Fiscal year ending June 30, 1918.

*G. McCook*  
Lieut. Col., U.S. Army

MISSISSIPPI RIVER COMMISSION  
FOURTH DISTRICT.

**BARATARIA LEVEES.**

UNDER THE DIRECTION OF  
Lieut. Col. G. M. C. Derby, U.S. Army.

W. E. Knobloch, Asst. Engineer.

Drawn by *G. M. C. Derby* June 1918.  
Traced by *G. M. C. Derby* June 1918.

- Established Commission Grade.
- x Highest Water Level 1912.
- Levees built by U. S. 1917-1918.
- Levees enlarged —" —" —"
- Levees built by Local Authorities, 1917-1918.
- Levees enlarged —" —" —"
- Levees with concrete revetment by U. S.
- Levees with wooden revetment by U. S.

Scale of Feet  
10000' 20000' 30000' 40000'

40 Mis.

50 Mis.

60 Mis.

70 Mis.

RELAS.

FORT JACKSON

1048.4 Mis. below CAIRO.

CAIRO DATUM.

Station 0

500

1000

1500

2000

2500

3000

3500

# RIVER COMMISSION.

PLATE No 12.

90 MI

VER COMMISSION.  
DISTRICT.

RAIN LEVEES.

DIRECTION OF  
C. Derby, U.S. Army.  
, Asst. Engineer.

*B.D.* June, 1918.

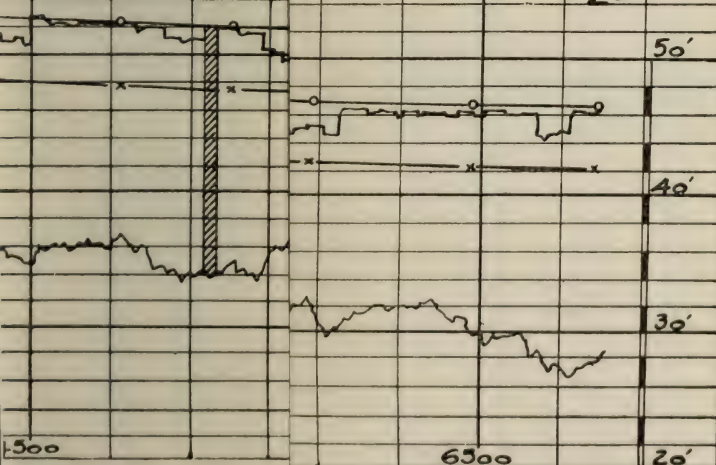
*M.A.* June 1918.

of Feet.  
00' 20000' 30000' 40000'

20 MI

NEW ORLEANS.  
957.0 MI. BELOW CAIRO.

Reserve, New 1918, Under Construction.



New Orleans, La.  
To accompany Annual Report for  
fiscal year ending June 30, 1918.

*G. McCollum*  
Lieut. Col., U.S. Army.

MISSISSIPPI RIVER COMMISSION.  
FOURTH DISTRICT.

# PONTCHARTRAIN LEVEES.

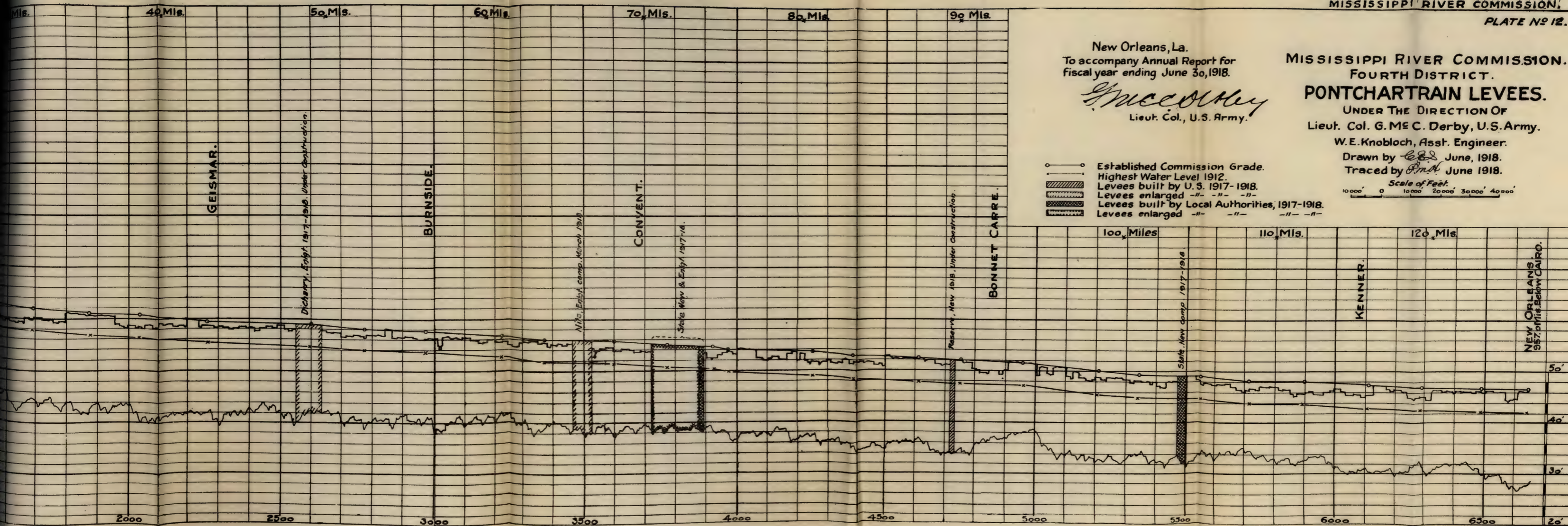
UNDER THE DIRECTION OF  
Lieut. Col. G. M. C. Derby, U.S. Army.  
W. E. Knobloch, Asst. Engineer.

Drawn by *G. M. C. Derby* June, 1918.

Traced by *G. M. C. Derby* June 1918.

- Established Commission Grade.  
 — Highest Water Level 1912.  
 [Hatched Box] Levees built by U. S. 1917-1918.  
 [Cross-hatched Box] Levees enlarged —" —" —"  
 [Dotted Box] Levees built by Local Authorities, 1917-1918.  
 [Stippled Box] Levees enlarged —" —" —"

Scale of Feet:  
10,000' 0 10,000' 20,000' 30,000' 40,000'



PI RIVER COMMISSION

PLATE No 13.

ER COMMISSION.  
DISTRICT.

NE LEVEES.

DIRECTION OF

. Derby, U.S. Army.

Asst. Engineer.

B.S. June 1918.

r.H. June 1918.

Feet.

0 20,000 30,000 40,000

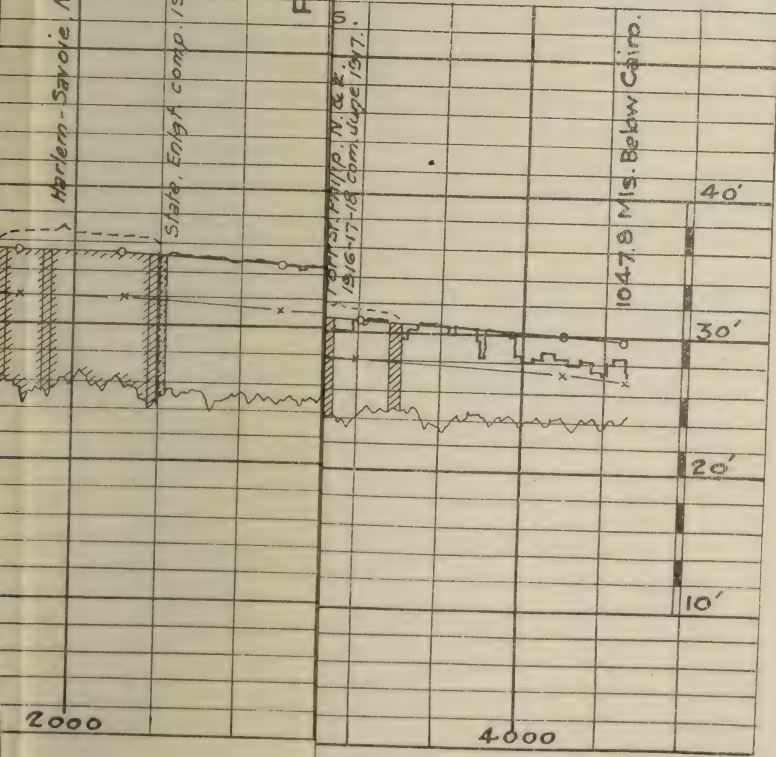
PT. A LA HACHE.

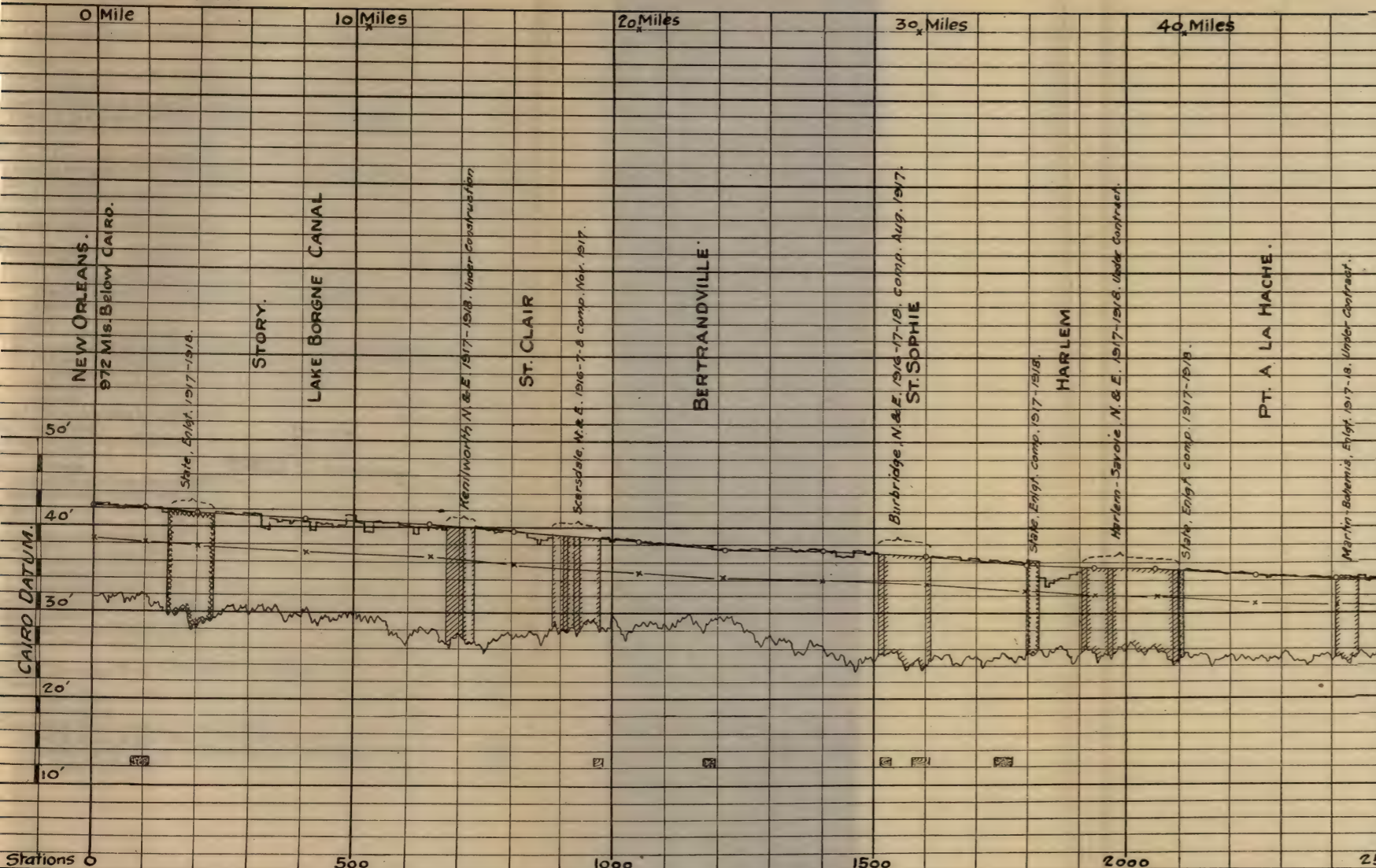
Harlem-Savoie, N. & E. 1917-1918. Under Contract.

State, Engrt comp. 1917-1918.

1916-17-18 Com. June 1917.

1047.8 Mls. Below Cairo.





New Orleans, La.  
To accompany Annual Report for  
Fiscal year ending June 30, 1918.

*Grace H. Lee*  
Lieut. Col., U. S. Army.

MISSISSIPPI RIVER COMMISSION.  
FOURTH DISTRICT.

LAKE BORGNE LEVEES.

UNDER THE DIRECTION OF  
Lieut. Col. G. Mc C. Derby, U.S. Army.

W.E. Knobloch, Asst. Engineer.

Drawn by *E.S.S.* June 1918.

Traced by *J.M.H.* June 1918.

Scale of Feet.

10,000 0 10,000 20,000 30,000 40,000

- Established Commission Grade.
- x — Highest Water Level 1912.
- ▨ Levees built by U. S. 1917-1918.
- ▤ Levees enlarged — 1917-1918.
- ▥ Levees built by Local Authorities, 1917-1918.
- ▧ Levees enlarged — 1917-1918.
- ▩ Levees with concrete revetment by U. S.
- Levees with wooden revetment by U. S.

## APPENDIX 5.

*Typical index to Annual Report of the Mississippi River Commission for 1918.*

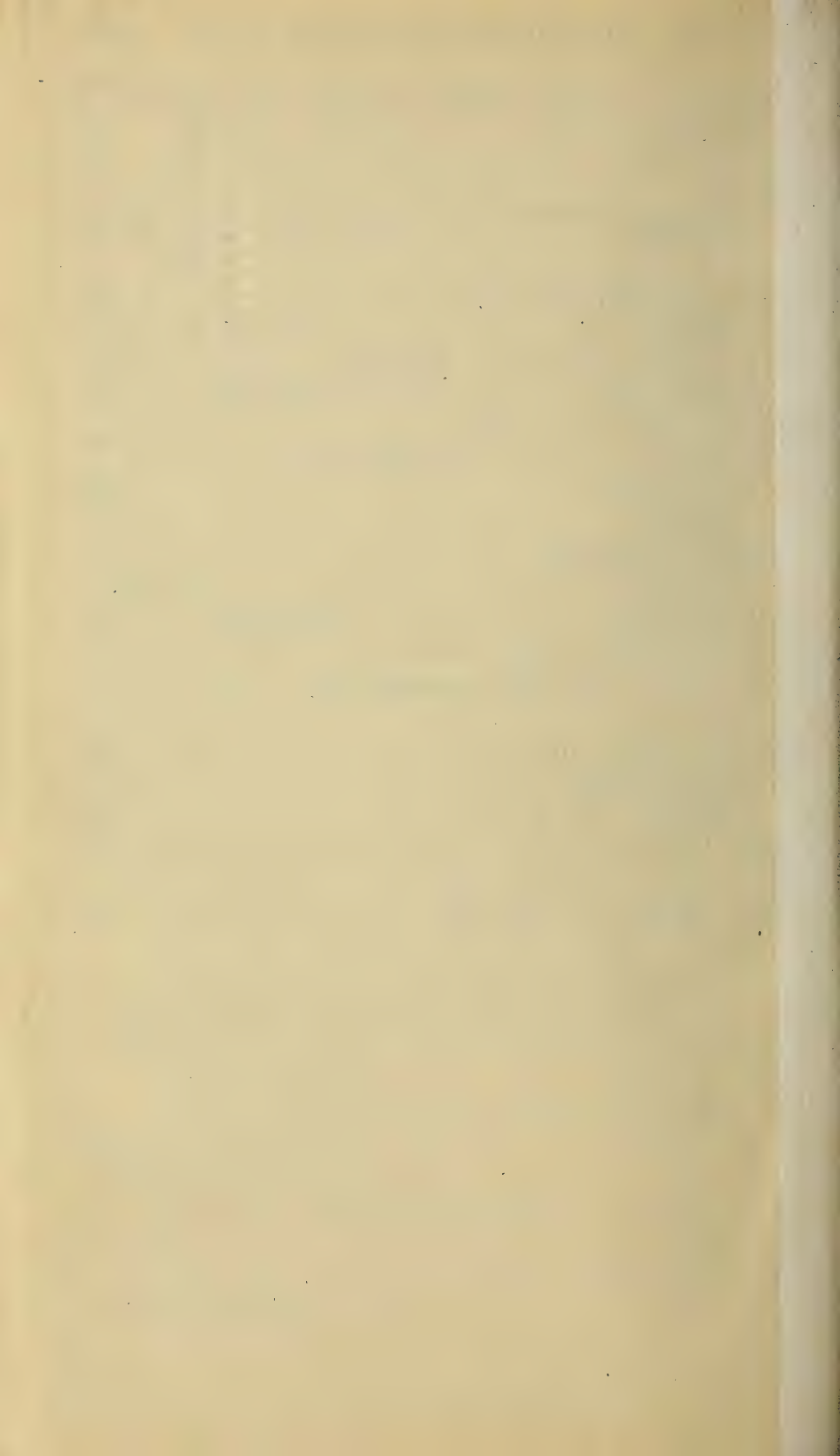
|                                                                                                | Page.      |
|------------------------------------------------------------------------------------------------|------------|
| Allocations:                                                                                   |            |
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| Depths and widths of channel during lowest stages of year.....                                 | 3472       |
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| Cal, amount received, etc.....                                                                 | 3529       |
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| Fourth district given following each work.....                                                 |            |
| Contributed funds, fiscal year 1918, under flood-control act.....                              | 3466       |
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| Fourth district, repairs, etc.....                                                             | 3730       |
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| In charge, Mississippi River and tributaries reported.....                                     | 3522       |
| Results.....                                                                                   | 3549       |
| Docks, marine railway, at West Memphis, Ark.....                                               | 3528       |
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| In Memphis Harbor.....                                                                         | 3593       |

## Dredges and dredging—Continued.

## Mississippi River, Cairo to Head of Passes—Continued.

|                                                                                                   |            |
|---------------------------------------------------------------------------------------------------|------------|
|                                                                                                   | Page.      |
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| Fourth district given following each work.....                                                    |            |
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| Third district.....                                                                               | 3661       |
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| Table showing area of land protected, condition, and extent of levees in all districts—           |            |
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|-----------------------------------------------------------------------------|------------|
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| Fourth district.....                                                        | 3730       |
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| New plant—                                                                  |            |
| First and second districts.....                                             | 3614       |
| Third district.....                                                         | 3667       |
| Fourth district.....                                                        | 3730       |
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| Third district.....                                                         | 3669       |
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| Third district.....                                                         | 3661       |
| Fourth district.....                                                        | 3701       |
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| Third district.....                                                         | 3666       |
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| List of accompanying report of secretary.....                               | 3533       |
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ANNUAL REPORT OF THE CHIEF OF ENGINEERS, 1918

EXTRACT

REPORT OF THE MISSISSIPPI  
RIVER COMMISSION



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1918









UNIVERSITY OF ILLINOIS-URBANA



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